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MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1830.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JANUARY, 1830.

With Remarks and Exemplifications, by the Editor.

1. For a method of *Ascertaining the Weight of the Cargoes of Boats, Ships, or Vessels*, called a "TONNAGE METER;" Eleazer Cady, Canaan, Columbia county, New York, Jan. 6.

A tube of iron, copper, or other metal, furnished with a stop cock, is to pass through the bottom of the vessel in any convenient situation; this is to be surmounted by a glass tube, standing vertically. When a ton of goods is put on board, the height to which the water rises in the tube is to be marked upon a scale, into which it is inserted, and so of a second, or any number of tons. This scale may be subdivided in the manner of other scales. A plumb line is to be suspended to ascertain the trim of the vessel.

"*Invention claimed.*—What I claim as my invention, is, the above described instrument for measuring the tonnage of a vessel, containing the glass tube and graduated scale. Also the plummet for determining the trim of the vessel."

Without adverting to other similar plans, we refer our readers to the notice of a patent taken out by Thomas Cohoon, of Troy, New York, dated June 18, 1829. This will be found at page 189 of our last volume. The mode of weighing goods in boats, there designated, is the same in principle as that above described; similar tubes are to be used, with one exception, they are to be wholly of metal, and the weight indicated by rods sustained by light floats.

2. For a method of *Warming and Ventilating Rooms*, by the burning of anthracite, or other coal, in what is denominated the "DORIC FIRE-PLACE, OR STOVE;" John Pierpont, Boston, Massachusetts, January 6.

The apparatus described by the patentee, is, "an open and portable fire-place, or stove, which may be made of a variety of different forms, but in every form must be constructed and arranged upon the principle of supplying to the room that is to be warmed and ventilated, in lieu of the air that through the smoke flue or chimney that passes out of it, and that by the operation of the fire itself, an equal quantity of fresh air from without the room, which, as it comes in, is warmed by being made to pass over, or between the heated surfaces of bodies that have not been brought into contact with a burning substance."

"The method of warming and ventilating rooms by means of any combination or arrangement of this principle, is what I claim as my invention."

"The doric fire-place may be made so as to stand either within the jambs of a common fire-place, or in a parlour, hall, or other large room in which there is no fire-place."

The name of "*Doric Fire-place*," is given to this apparatus from the doric columns which form a part of the ornaments of those which have hitherto been made.

The exterior of the stove, or grate, is in very good taste, and, but for the embargo which was instituted, and has been enforced, by the severity of the season, we should now have told the story of its actual operation, as the favourable judgment which we formed of it from the description and drawings, and our knowledge of the talents and truth of the inventor, induced us to give orders for one. Hereafter we will resume the subject, and give such a description of the apparatus, and such remarks upon its operation as observation and experience may justify.

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3. For improvements in the machinery of mills for the *Manufacture of Grain into Flour or Meal;* Jesse C. Smith, Wheeling, Ohio county, Virginia, January 9.

What is claimed as new in the structure of mills, is the manner of framing and connecting the pressure rod with the bridge tree, and the using an elevating screw, in such a way "that the relative position of the faces of the stones is secured against any change by reason of an increased or diminished velocity of the runner," with certain other particular arrangements all tending to the same object.

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4. For a *Machine for Washing Clothes;* William Arnold, Haddam, Middlesex county, Connecticut, January 11.

Very much like "a century of inventions" for the same purpose, and, no doubt, equally good with many of them, and destined to live to an equal age.

The claim is to "the arrangement and putting together the various parts."

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5. For an improvement in the *Plough;* James H. Conklin, Peekskill, West Chester county, New York, January 13.

The mould board and share of this plough are both to be of cast iron; the share is separate from the mould board, and they are to be fastened together by sockets and pins in a manner described by the patentee; the distinguishing feature of the invention is the making the share in such a form that it is precisely alike on each of its edges and sides, so that when one edge and point are worn out, it may be turned and fastened as before, "thus causing it to last twice as long as the ordinary share, without any increase in its cost."

The claim is to the share, as described, and to the mode of fastening it on.

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6. For an improvement in the *Plough;* Thomas Borden, Portsmouth, Newport county, Rhode Island, January 13.

"The description is as follows. The frame and beams of the plough is in a *triangular* form, with handles in the usual form; into the frame is fitted three shares composed of cast iron, wrought iron, or steel; the one in front, attached to the beam, is a *double* share, and on each side, attached to the frame, is a single share. By passing the plough between the rows of corn, &c. the earth will be turned each way towards the rows, which will greatly facilitate the operation, and save great part of the hoeing, in the common way."

"THOMAS BORDEN."

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7. For a *Domestic Knife Sharpener;* Philip Cornell, Brutus, Cayuga county, New York, January 15.

It seems by the description that two blades are to be set into a handle, in such a way that by means of a screw, they may be made to form any desired angle with each other. The knife to be sharpened is to be drawn between these.

Several instruments similar in principle, have been previously described by us. There is no claim made by the patentee. A model of the instrument has been deposited in the patent office, but no drawing has been furnished. If the patent law means any thing where it makes an absolute demand of a drawing with references, "*wherever the nature of the case admits of drawings,*" the present patent must be entirely invalid. If a *machine* can be described, and a *model* can be made, it certainly *admits of drawings.*

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8. For an improvement in the *Plough;* A. D. Armstrong, Springfield, Clarke county, Ohio, January 15.

In the specification and drawings which accompany this patent, a particular description is given of the manner of forming and connecting together the various parts of this plough. They consist,

principally, in minute points of form, and modes of connexion. The claim is also to a great number of minute particulars, as "the additional depth of the bar; the greater drop of the share; the position of the line at the forward edge of the mould board; giving the shape, or wind, whereby the face of the plough can be swept clean by the motion of the sod, or straight edge, when using the plough; the angle which the forward edge of the share makes with the bar, and the proportions, generally, of the mould board."

The foregoing is but a short sample of the claims, many of which are, from their nature, indefinite, and others, certainly not new.

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9. For an improved machine for *Shelling Clover Seed;* Jacob Gorgas, Frederickburg, Lebanon county, Pennsylvania, January 15.

There are two circular metallic plates 2½ feet in diameter, which are punched so as to form graters, or rubbers, such as have frequently been used for cleaning grain, they are fixed upon wood, and stand vertically in a frame; one of them is stationary, and the other made to revolve by means of a crank; an opening is made through the stationary rubber, to admit the seed to pass from a hopper, so as to be subjected to the rubbing process; it passes out around the edges, where pieces of leather are placed which are to complete the operation.

The claim is "the construction of the above described machine, with the use of the circular metallic rubbers, and the leathers."

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10. For an improvement in *Pounding, Grinding, and Separating Gold from the Earth, Stone, or Rock;* Samuel Whisler, of Rockingham county, and James Smith, of Spottsylvania county, Virginia, January 15.

The first operation prescribed is to put the ore into a trough, to subject it to the action of stampers.

The second is to grind it by placing it in a circular trough, where stones, like those used in the old bark and drug mills, roll over it.

The gold is then to be separated by washing in an iron, or other trough, amalgamated by mercury, then "put into a still, the quicksilver evaporated and the gold collected."

"*The invention claimed.*—What we claim as our invention, is, the above described machine, for pounding and grinding metallic ores."

It would seem incredible, but for the repeated evidences of the fact, that men should throw away their money to obtain patents for what is not merely old, but perfectly common. There is not in the foregoing even the semblance of novelty, either in the machinery, or the mode of operation; in our estimation, the patent is just as good and no better than one would be for grinding grain between mill stones.

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11. For an improvement in the manner of *Spreading Blister*

Plaster, commonly called Blister Cloth; Elisha Perkins, Physician, Baltimore, Maryland, January 15.

The plaster is to be spread on the cloth by means of iron rollers like those of a flatting mill, and turned in the same way. The rollers may be about 22 inches in length, and five inches in diameter; the upper roller before using it, is to be taken out and heated in boiling water; when replaced, the cloth is to be passed between the rollers. A roll of the composition to be spread is placed upon the cloth, in contact with the heated roller, and, by turning, spread thereon. The plaster is to be without any of the fly in its composition, as this is to be dusted upon the surface after it is spread, and affixed by folding the cloth and again passing it through the rollers when cold.

There is some ambiguity in the specification, which renders it uncertain what was intended to be patented; the patentee tells what he does not claim, but has not informed us what he does, excepting in the following declaration, that "this improvement consists in the spreading of the plaster by means of two cylindrical rollers of cast iron, brass, or other hard metal, and in spreading the fly altogether upon the surface of the plaster." The mode of effecting the spreading is by rollers, which rollers are described, but unaccompanied by any drawing; the patent, therefore, if for the machinery, we should deem invalid. The second item, that of spreading the plaster without the admixture of the fly, has no claim to novelty, we have done it hundreds of times, and, in fact, it was the uniform practice of the gentleman from whom our first medicinal instructions were received, and, we believe, that it is still frequently done.

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12. For a *Machine for Excavating Earth under Water,* called a "Floating Excavator;" Alanson Watson, Pendleton, Niagara county, New York, January 18.

A scow, or boat, is to have an opening through its centre, of about 4 feet in width, and 14 in length. A flat piece, called a scraper, is to be let down, horizontally, through this opening; the fore end of the scraper is to be supplied with two plough-shares, one at each corner: the scraper is to be lowered, and raised when loaded, by means of two racks and pinions, and a rope and windlass. When the scraper is to operate, the boat is to be drawn forward by means of a rope attached at one end to an anchor, or other fixed object, and at the other to a windlass in the boat.

"*Invention claimed.*—What I claim as my invention, is, the before described machine, with the use of the plough-shares, racks, and pinions, and cylinder [wheel and axle] for raising and lowering the scraper."

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13. For an improvement in the art of *Catching Ducks, Geese, Swans, and other Fowl;* William Coffield, Norfolk, Norfolk county, Virginia, January 18.

A net is to be made of small and strong twine, with meshes of five or six inches square; it is to be as large as can be conveniently managed. This net is to be spread over the water, whilst the ducks, &c. are below, feeding on the roots of aquatic plants; on rising, they will be caught by the neck in the meshes.

"Secondly, the same kind of net, and to any size, may be placed horizontally, near the bottom, where the ducks feed, which will catch them by their necks, as they dive for their food."

The net may also "be set perpendicularly, and be drawn over the ducks, by means of lines, whilst feeding at the bottom, thereby catching them by their necks as they ascend."

A net is sometimes to be fixed permanently by one edge, either on water or on land, and is to be cast dexterously "over ducks, geese, swans, or any other fowls, by means of strong wooden or steel springs, which are to be managed by means of lines leading to the shore, or elsewhere, as may be most convenient."

We leave all judgment upon the foregoing to those who are in the habit of handling nets, and catching ducks, geese, and swans, as the information given affords but little light to the uninitiated. With respect to the last plan proposed, as we apprehend that the "strong wooden or steel springs" must have something peculiar in their structure and arrangement, we should have been glad of some further description, and a *drawing*, as guides to their formation and use; but the patentee has left us in the dark in this important particular.

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14. For an *Improved Tiller Wheel,* for steering vessels; Cornelius Tiers and Joseph Myers, Philadelphia, Pennsylvania, January 18.

The specification, with engravings, shall hereafter be given.

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15. For an improvement in the *Machinery for Sawing Boards, Timber, &c.;* David Flagg, jr., Gardiner, Kennebeck county, Maine, January 19.

Two circular saws are to be made, one of which is to run immediately under the other, with their peripheries as near as may be, without touching. The object is to saw on the two sides of a log, as "by these means timber may be cut of a size nearly equal to the half [whole?] diameter of each saw."

The claim is to "the application of two saws acting together, as above described."

By turning to page 259, vol. 4, first series, an account of similar machinery will be seen, with an accompanying drawing. It was the subject of a patent granted in England, to George Sayner and John Greenwood, for improved sawing machinery. In one point, at least, the apparatus there described is better than that above noticed; two circular saws are used, one above, and the other below the log, but they are placed a little in advance of each other, so that each may cut a little beyond the centre of the log; in other respects they act as in the machine claimed by Mr. Flagg.

16. For *Hewing, Picking, and Drilling Stone* by machinery; Linus Yale, Salisbury, Herkimer county, New York, Jan. 20.

There is a lever, or levers, with steel picks, chisels, or hammers, at one end. The lever works on a pivot, at, or near, its middle, the end opposite to the chisels being operated upon by a wheel, with cams, or lifters, like a tilt hammer, so as to make the lever vibrate and the chisels cut. A wooden, or other spring, bears upon the lever so as to keep it in its proper position.

The stone is to be placed upon any convenient kind of carriage, that it may be moved about to be operated upon by the chisels, &c.

"The main object of the petitioner, is, to prohibit all persons, without his consent, until the patent expires, from hewing, picking, or drilling of stone, by means of steel picks, chisel, or hammer, attached to any lever, or levers, handle, or handles, sustained as aforesaid by springs made of wood, wire, or steel, and propelled by a shaft set in motion by hand, horse, water, or steam power."

We fear that Mr. Yale will not accomplish his "main object," as there are a number of American and European patents for applying chisels, &c. for cutting and picking stone, both flat and in the form of mouldings, in which levers, or handles, are certainly used in a way which, we apprehend, will interfere with this *subsequent* claim.

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17. For a machine for *Thrashing Wheat, Rye, Oats, and Barley;* James Clark and Isaac Starks, Geneva, Cayuga county, New York, January 20.

The feeding rollers, apron, beaters, hollow segment, or shell, as it is here called, so perfectly resemble many other thrashing machines, as to render it impossible for us to touch a single point of novelty in it.

What is claimed "is the yielding bed, shell, or floor," "and the stationary beaters on the main cylinder."

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18. For *Improvements in Locks;* George A. Rogers, Augusta, Kennebeck county, Maine, January 20.

The bolt of this lock is to be operated upon by toothed wheels, and an endless screw; the key is like that of a clock; there are certain checks, pinions and racks, which could not be described without drawings, and, from a cursory inspection, it does not appear to us to possess any peculiar claim to notice. The whole apparatus is described, and no claim made to any particular part.

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19. For a machine for *Thrashing Clover, Herd Grass, Rice, Wheat,* and other small grain; Henry C. Atwood, Litchfield, Connecticut, January 23.

Beaters on a cylinder, working in a hollow segment, and the other *et cæteras* which usually constitute a thrashing machine, are here again assembled. The segment is to be composed in part of squared

or fluted rollers, and in part of triangular pieces; the boxes of the cylinder are to have play, to let the cylinder give back in case of a stone. Some minute directions are given as to the form of the beaters, and upon them, if upon any thing, the novelty depends. The patentee says, "what I especially claim as my invention is the oval or triangular bars placed in the concave; the relief beaters on the cylinder, and the fluted rollers at the bottom of the concave, which conduct the straw when thrashed, clear of the grain."

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20. For an improvement in the apparatus and process to be employed for *Purifying, Refining, and Settling the Salt Water of the Ocean, and the Brine of Natural Salt Springs*, for the manufacture of muriate of soda, or common salt, by artificial heat; Seth Hunt, now of the state of New York, January 23.

The preceding patent is taken, principally, for the application of heat to the brine while in the settling vats, cisterns, or reservoirs, for the purpose of throwing down and separating therefrom the sulphate of lime, and other earthy impurities with which it is impregnated.

The specification is of considerable length, and appears to be worthy of a more particular notice than we can here give it; we shall, therefore, take it up again, and make such an abstract as will place its merits before the public.

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21. For a new method of *Propelling Vessels in or through the Water;* Benjamin Phillips, Shipwright, Philadelphia, Pennsylvania, January 23.

The method proposed consists of "a newly constructed case or cylinder, with valves in it for propelling vessels in or through the water," to be used instead of paddle wheels. A patent was taken out by the same gentleman for a similar purpose, of which we gave an account in the 2nd volume of the new series, p. 256. We apprehend that his former plan has been abandoned, and the fate of the new scheme, we have little doubt, will correspond with that of its predecessor. The new proposition is to have hollow cases, open at both ends, which cases are to slide from stem to stern of the vessel, at each of its sides, there being a steam engine, or other power, to move them. Valves, closing like shutters, which are to be hung by their upper edges, are to open as the case retreats, and close when it moves in the reverse direction. It is proposed sometimes to suspend these boxes in the manner of pendulums, which, in vibrating one way, will open, and in the other close the valves. The patentee compares these valves, in their action, to the opening and closing of venetian blinds.

The claims are to "the cases, the manner of fixing the valves within the case, the manner of connecting them to the steam engine, applying the power alternately, as one case slides aft, or propels the boat, the other case is sliding forward, its valves open, and on

the return its valves shut down, and the other valves open. The cases may be either *copper*, *iron*, *wood*, or *metal*." "I claim being the inventor of this principle of propelling, or pumping vessels through the water, without causing any waves, or sea, or ruffling its surface."

We do not think it necessary to reason upon the subject of the total inadequacy of the foregoing to effect the object proposed, excepting to such as are altogether uninformed respecting it, and to these we have not time to attend.

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22. For an improvement in the mode of *Evaporating Fluids, and Drying Cloths, Wool, Silk, Paper, &c.* without assistance from heat; Joseph Hurd, jr., Boston, Massachusetts, January 23.

The specification commences by stating that the "improvement consists in giving motion to the objects from which water, or moisture, is to be expelled."

A large revolving frame is to be made, in form something like a reel; upon this the cloth, or other article to be dried is extended, and fixed by tenter hooks, or otherwise.

"The shaft is to be put in motion by water or other power. The evaporation will increase in proportion to the velocity of the motion. When the motion is very rapid, the effect is not merely evaporation, but water is sensibly thrown out of the cloth by centrifugal force."

"It may be used with great effect for evaporating salt water for the purpose of making salt. The water may be thrown into a basin on the top of the shaft, having holes in its bottom, through which the water might pass and trickle down ropes, boards, coarse cloths, or any thing more suitable, which should be suspended and connected with the upper and lower parts of the shaft."

This apparatus is certainly well calculated to promote evaporation, and will, we think, be found applicable to many useful purposes.

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23. For an improved mode of *Taking the Figures of Ingrain Carpets from the Cloth;* William Sherwood, Somersworth, Strafford county, New Hampshire, January 26.

The plan proposed appears to be simple and ingenious, but the accompanying drawings are not sufficiently descriptive. The points claimed, are, "*First*, the raising of the figure by a combination of levers, independent of hooks and knot cords. *Second*, the application of a machine to change the shuttles, by accelerating the motion of the boxes, so as to make either of the treadles which work the figure, raise them different heights at different times, the motion of the treadle being always the same. *Third*, the method of using four shuttles. *Fourth*, the raising all the shuttle boxes between the upper and lower ones, by rests which cannot raise them any higher than to throw the shuttle required. *Fifth*, the placing the cloth beam back of the harness, and bending the cloth from the breast beam to it. *Sixth*, two methods of regulating the tension of the weft, as described."

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S. T. JONES'S RAIL-WAY CARS AND WHEELS.
PLATE II.

24. For a *Lock for Securing Doors, Trunks, Chests, &c.;* Asa Beals, Exeter, Rockingham county, New Hampshire, January 26.

This is a combination lock, to be set by indexes, in a manner well known to those who are curious on such subjects. The patentee describes his lock, but does not claim any thing appertaining to it. We do not know, therefore, what part he esteems to be new.

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25. For an improvement in the *Boxes, or Hubs of Wheels for Carriages,* also in ship blocks, and boxes for machinery; Isaac Cooper, Baltimore, Maryland, January 27.

The axle is to be surrounded by friction rollers, contained within the hub, or nave, of the wheel, or within the boxes of machinery. This, as we have repeatedly remarked, was effected about fifty years ago, by Mr. Garnett, of England, and patented by him. There is but little difference between his mode, and that described by the present patentee, and we are fully convinced that the latter is not by any means an improvement upon the former. The hub proposed to be used is to be of cast-iron; there does not appear to be any thing in it, particularly worthy of notice, or materially different from such as have been previously patented.

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26. For a *Tread Wheel Rail-way;* Benjamin Sutton, Romulus, Seneca county, New York, January 27.

This "Tread Wheel Rail-way is intended to be used for the purpose of raising and elevating earth, stone, and other weighty substances out of canals, or other excavations, or for raising embankments for any purpose, and is particularly applicable to the propelling or elevating of cars and carriages upon the ordinary, or common inclined rail-way now in use."

The specification states the following to be the claim of the patentee.

"The improvement (the invention whereof I claim) is the tread wheel, by which the entire weight of one or more men is made to act with ease and convenience upon the car, weight, or burthen to be raised, or drawn up."

"The machine may also be applied with advantage to the elevating or lowering of burthens in a perpendicular direction, by placing the rope, strap, or chain, over a pulley directly above the burthen to be raised."

The size of the drum, or tread wheel, we are told, may be from six inches to twenty feet in diameter, according to the weight to be raised.

This patent tread mill, or wheel, is precisely like other tread mills, which may answer very well to keep culprits employed, but the power of a man thus applied, has not been found to be very nearly related to *ease and convenience.*

Tread wheels for cranes, and for raising water from wells, have

been in use time out of mind. Men and other animals have generally, however, been employed to turn them, by walking within a hollow drum, in preference to using steps on the outside.

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27. For a machine for *Forming or Constructing Hat Bodies;* A. H. Stevens, Richland, Oswego county, New York, Jan. 27.

The specification states that this is an improvement upon the machine for forming hat bodies, invented by H. F. West and A. H. Stevens.

The wool is to be delivered from a carding machine in a continued sheet, and is to be received upon an endless apron, revolving on rollers with the proper speed; the hat former resembles two cones, joined at their bases; it is improperly called a cylinder in the specification. This former is to be made hollow, that it may be light, is to be covered with cloth, that it may take hold of the wool, and is to be rolled over the fleece by hand, being tilted from side to side, as, from its form, it rolls towards either edge, and this diagonal rolling causes the fibres to cross in the manner requisite for forming the body. The claim is to "the round cylinder" [double cone] "or splint hat former; and substituting it for the board, or flat hat former, of West and Stevens."

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28. For a *Churn*, called the "Cradle Churn;" John Barber, Carolina, Tompkins county, New York, January 28.

A box is placed upon rockers; this box is divided into two compartments by upright slats, having spaces between them; as the churn is rocked, by means of a lever, or rod, the cream passes between these slats, and is of course agitated, so as, in due time, to produce butter.

There is no particular part claimed; we conclude, therefore, that the patentee considers the whole as new.

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29. For a *Machine for Thrashing Grain*, and hulling clover seed; Chester Clark, Colebrookdale, Berks county, Pennsylvania, January 28.

The beaters which surround the cylinder in this machine, or which rather form part of the skeleton of a cylinder, are to have their surfaces cut somewhat in the form of a coarse screw, and instead of being placed parallel with the axis of the cylinder, stand diagonally, so that one end of the beater shall come in contact with the grain, whilst its other end is at a distance, a second entering in the same way, before that preceding it has ceased to act. The mode of feeding; the concave segment; springs, &c. resemble most of the other thrashing machines. The claim is to "the screw formed beaters, and the general construction of the above described machine."

The screw formed beaters may be new; the general construction seems to be a claim not very securely founded.

Vol. 3 S. T. JONES'S RAIL-WAY CARS AND WHEELS. PLATE II.

30. For an improvement in the art of *Cleaning Rice from the Hull, Husks, or Coats;* John Ravenel, Charleston, South Carolina, January 29.

Mr. Ravenel formerly obtained a patent for improvements in the mill for cleaning rice, of which we gave an account in vol. 4, p. 49.

The improvements now claimed, are the making the cranks, which work the pestles, so short, that they shall never be lifted above the surface of the grain in the mortar; thus producing economy in time, and in the expenditure of power. The cranks situated upon the same shaft, for working rows of pestles, are distributed around it, so as to form radii of equal angles with each other, by which means the power is equalized, no two pestles having the same action at the same time.

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31. For constructing *Patterns of Metal, Wood, or other Material, to be used as Moulds for Casting;* Jonathan Leonard, jr., of Meriden, Jareel, S. Brainard, and Amasa Sizer, of Wallingford, New Haven county, Connecticut, January 28.

The invention claimed to have been made by the patentees, is, "a new and useful mode of constructing patterns formed of metal, wood, or other suitable material, and consisting of a plate with raised work, or projecting figures on each side thereof, to be used in making moulds, the parts of which are in different parts of a flask, and which moulds are fitted for casting work in iron, or other metal. But we do not claim the exclusive right of making patterns for moulding, or any mode of using them which has heretofore been practised."

It has been a common practice in moulding spikes for ships, and many other articles which are to be cast in great numbers, to fix one-half of the patterns on one mould board, and the corresponding halves upon another, so as to mould upon the principle above pointed out. Metal plates with one-half the pattern on each side have also been used, and a patent obtained for them. A particular account of this will be found in our list of patents for March, 1829, at page 419 of vol. 3, new series.

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32. For an improvement in *Taps and Dies;* Archibald Lamont, Pittsburgh, Allegheny county, Pennsylvania, January 29.

The peculiarity in the taps consist, principally, in the body, or solid part of the tap, within the thread, being perfectly cylindrical, whilst the whole form would be conical, were the spaces between the threads filled up. At the point of the tap the thread commences at nothing, as it is technically termed, whilst at the upper part the thread is of the full depth required. The diameter at the top, therefore, exceeds that at the bottom by double the depth of the thread. Two flutes are made on opposite sides of the tap, in order to form the cutting edges, and to allow of space to receive the cuttings.

This appears to us to be a good form for a tap, especially for a square threaded screw, such as is represented in the drawing ac-

companying the patent; it, however, is spoken of as applicable to such as are rounded or mitred; but the formation of these certainly would be attended with much greater difficulty.

"Of the dies. The cavity of the dies by which the screw is made forms an entire and complete circle, having two circular openings across the centre of the dies, which form the cutters and also prevent the passing off of the chip. The screw in the dies also commences at nothing, or a plain surface, and gradually increases until the thread acquires the full size."

According to the drawings, the "two circular openings" are two flutes on each die, filed along side of the screw, to form a cutting edge.

These dies do not appear to us to promise so fairly as the taps; if a thread could be cut the whole depth at once, they would act well, but this, generally, is out of the question; only one cutting thread can be in action at once, and that the most prominent. A complete circle, offers no small practical difficulty in cutting deep threads with dies.

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33. For an improved *Thrashing Machine;* Edward Warren, City of New York, January 29.

In this machine, instead of beaters along a cylinder, rows of iron teeth, about an inch square, and about the same distance apart, extend from end to end, the rows being about four inches from each other. The spaces in one row are opposite to the spurs, or teeth of the next. The concave segment, and other parts are pretty much like a host of others.

"What is claimed by this improvement, is, the spurs acting upon the grain over the concave bars."

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34. For a mode of *Manufacturing Axes by Machinery,* called the "Oval Axe Machine;" Stephen Hyde, Williamsburgh, Hampshire county, Massachusetts, January 29.

The patent for the object above stated, is obtained for giving to the hammer and dies, which may be attached to the common trip hammer, such shapes as shall give to the iron the form which prepares it for receiving the steel, and forming the eye, so that by the use of this improvement but one person is required in making axes.

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35. For a *Thrashing Machine;* Joel Dewey, jun., Troy, Rensellaer county, New York, January 29.

If our readers are not ready to make a truce with thrashing machines, we are; the only comfort attending their consideration in the present month, is, that they appear to have excluded the washing machines from the contest.

In this machine, upon what would otherwise be *beaters,* wires are fixed in rows, and form *pickers.* The grain is fed to these pickers by fluted rollers. Instead of being carried down, the grain is carried

up, the segment which encloses it being placed above. The inventor says—

"What I claim as new and my own discovery, in the above described machine, and for which I ask an exclusive privilege, is, the manner of feeding, and its operation on the grain being backwards, which thrashes the loose heads; and its *being new in almost all its parts.*"

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36. For a *Churn;* John Ewing, Westboro, Worcester county, Massachusetts, January 29.

This is very much like the common barrel churn with four dashers, but instead of a barrel, an oblong box contains the cream and the dashers. Upon the shaft is a cog wheel of 10 inches diameter, which is to be acted upon by one of 5 inches diameter, there is also a fly wheel on the shaft.

We are told that "this new invented churn stands upon its own bottom," which is well enough; but as there is no claim, we are not informed if it is in this that the invention consists.

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37. For machinery for *Washing Gold out of Gravel and Sand;* Peter Summey, Lincoln county, North Carolina, January 30.

The machinery here patented is but very imperfectly described, and does not appear to present any principle, or arrangement, upon which to found an exclusive right. The earth to be washed is put into a vertical cylinder, in which it is agitated, by means of a revolving shaft, and the gold, and other heavy particles take the lowest station. From this cylinder the washings pass through a conductor, into a rocking trough, where the separation is to be more perfectly made.

There is no claim to any part.

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38. For making *Tow Lines for Towing Boats;* Aaron Bull, Carlisle, Tompkins county, New York, January 30.

Brass, copper, or iron wire, is to be laid between the strands of an ordinary tow line, "on the surface, so as to give strength and consistency to the line, and prevent as much as possible all friction and wear."

The claim is to the doing this.

We apprehend that these patent tow lines will not come into general use. The wire will be liable to break, will add to the weight, and thus increase the friction of the line, whilst it will be difficult so to place it as to form the prominent surface of the line.

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39. For an improvement on the *Tongue Plane,* used on the edges of flooring and other boards; Emanuel W. Carpenter, Lancaster, Lancaster county, Pennsylvania, January 30.

The tongue plane described in the specification, has two separate

irons and wedges, instead of the notched iron generally used; sometimes the irons are to be connected together by means of plates and screws at their upper ends; in either case the object is to regulate their distance from each other, so that the tongue and groove shall always fit.

The same thing was patented more than a year ago, by Messrs. Longnecker and Myers, of Lancaster, as may be seen by turning to p. 336, vol. 3, new series.

There is not any claim made.

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40. For a *Tackle, Windlass, and Lever Press;* John B. Carpenter, Henderson, Jefferson county, New York, January 30.

The claim to novelty in this press, is, "the application of the windlass, tackle, and lever, to the machinery for pressing."

It consists of a windlass standing across the press from one cheek to the other; this is to be turned by a handspike, there being a ratchet wheel and catch to prevent it from turning back. A rope from each end of the windlass passes round sheeves in the sliding frame. There are three represented in the drawing, but a greater number, it is stated, may be used; this windlass, with its tackles, operates upon the follower of the press, and draws it up, or down, according to the arrangement made.

Specifications of American Patents.

Specification of a patent for certain improvements in the construction of Wooden or Frame Bridges. Granted to S. H. Long, Bt. Lt. Col. of the United States Engineers, *March* 6, 1830.

The objects aimed at in this invention, are greater simplicity and economy in the construction of bridges, together with greater strength and efficiency than have hitherto been attained from any combination of principles, or arrangement of parts heretofore adopted in structures of this description.

The improvements under consideration, by means of which the objects above mentioned are to be accomplished, consist of the following modifications or arrangements, in the construction of the main longitudinal truss frames necessary to the formation and support of a bridge, viz.

1st. Two modes of splicing the string pieces, one of which is effected by means of wooden, and the other by means of iron splicing pieces of a construction different from any heretofore adopted in bridge architecture.

2nd. A system of bracing, by means of which the truss frames are exempted from leverage in every part liable to be affected by such an action, and the stresses or thrusts communicated by the braces, are resisted by shoulders or steps as nearly as may be at right angles with the grain, or fibres of the timber.

Fig. 1.

Fig. 2.

3d. A system of counterbalancing, by means of which the truss frames are rendered stiff and unyielding, and the bridge kept in uniform action, whether loaded or unloaded.

4th. A mode of furnishing the main braces and posts with metallic bearings, by the introduction of thin plates of iron, copper, or other suitable metal, between the *heel* and *toe* of each main brace, and the steps in the post against which they thrust, and

5th. A mode of keying, or wedging, by means of which the central parts of the truss frames, and consequently of the bridge, may be elevated, and sustained, in case of a subsidence or sinking of those parts, which is liable to happen from a shrinking and extraordinary compression of the timber.

These several improvements which are claimed as new, useful, and original, together with a variety of other arrangements, many of which are believed to be unprecedented in bridge architecture, will be more clearly illustrated by the drawings and explanatory references hereto annexed, and exhibited under the designation of the "JACKSON BRIDGE."

EXPLANATIONS AND REFERENCES TO THE DRAWINGS.

Plate III.

Fig. 1. A side view of a truss frame exhibiting the systems of bracing adverted to in articles 2nd and 3d of the preceding specification.

A, B, the upper string showing the position of its splices, and the insertions of the posts, &c.

C, D, the lower string with its splices, &c. *Note.* Inasmuch as the upper string acts by thrust, and the lower by tension, the splices of the latter only require particular care and precision in their adjustment.

E and F, inferior arch braces, supported on the lower sill of the abutments, and inserted in the lower string immediately behind the 2nd and 3d posts from each extremity of the truss frame. G, superior arch braces connected with the centre post prolonged above the frame, and inserted in the upper string, at the head of the 2nd post from the centre.

a, the posts, *b*, the main braces, *c*, the counter braces.

Note. This figure is also intended to indicate the manner of constructing the Carrolton viaduct, which differs from the bridge only in its adaptation to the purposes of a rail-road, in which application the floor timbers must be more frequent in order to afford an unyielding support to the rails, and the arrangements in other respects must be such as to admit the free and safe passage of a locomotive steam engine. *m*, the positions of clamp bearers or floor timbers, attached to the posts by means of screw bolts.

n, the positions of intermediate floor timbers resting upon the main and counter braces at their junction and intersection, upper and lower.

Note. The relative distances between the strings and any two

S. T. JONES'S RAIL-WAY CARS AND WHEELS.

Fig. 1.

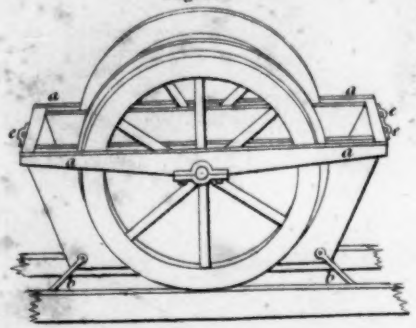


Fig. 2.

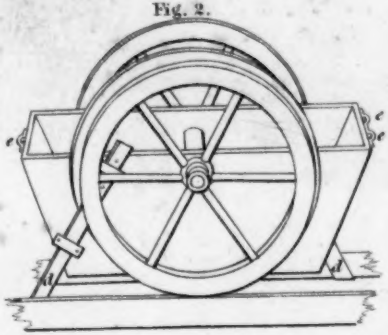


Fig. 7.

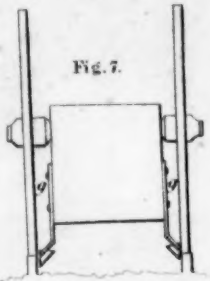


Fig. 8.

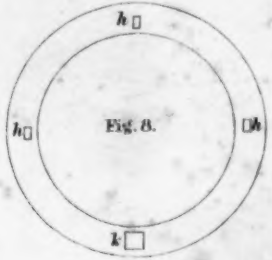


Fig. 5.

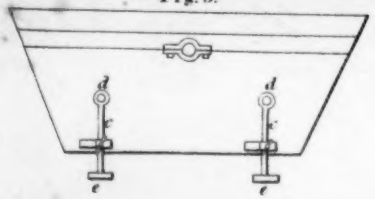


Fig. 4.

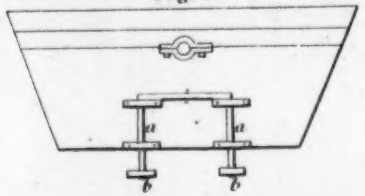


Fig. 11.

Fig. 10.

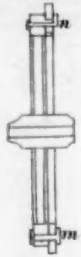


Fig. 9.

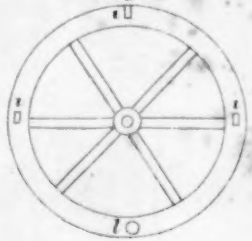


Fig. 6.

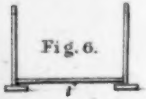


Fig. 3.

adjacent posts longitudinally of the truss frame, should be about in the proportion of 1½ to 1.

Fig. 2. A horizontal view of a bridge with single road-way and double truss frames.

Note. The right half of this figure, viz. BC, GH, presents a view of the lower strings, floor timbers, &c., and the left, viz. ABCD, a view of the upper strings, bearers, lateral braces, &c.

E, F, a streamer, midway of the bridge, affording the means of connecting the lateral braces, with the bearers.

a, the beams, *b*, the lateral braces, *c*, the splices of the upper and lower strings, *d*, the splices of the interior string piece of the lower strings, *e*, the floor timbers, *f*, lateral braces connected with the floor timbers, *g*, a short streamer affording the means of connecting the braces, *e*, with the floor timbers.

Plate IV.

Fig. 3. An end view of the timbers, &c. of the bridge. AB stay braces of iron, for maintaining the vertical position of the truss fames. C the upper and D the lower sill of the abutment. E the transverse braces. F the posts. *a*, the beams, and *e*, the floor timber.

Fig. 4. *a* and *e*, the same as in Fig. 3.

Fig. 5. Representing a portion of the lower string with its iron splicing pieces, &c.

a, the outside or exterior splicing pieces, *b*, the interior splicing pieces, *c*, the spliced ends of the exterior string pieces, *d*, the spliced ends of the interior string pieces.

Fig. 6. A side view of one of the interior splicing pieces showing the position of its transverse lugs.

Fig. 7. Representing a portion of the lower string with interior splicing pieces of wood.

a, the same as in Fig. 5, *b*, the interior splicing piece, which may be furnished with two counter shoulders, as in the figure, with four or with six shoulders, according to the stress to be exerted upon it.

c and *d* the same as in Fig. 5.

Note. The string pieces are confined together by means of screw bolts, passing entirely through the string at the splices and such other places as may be deemed necessary. The beams and floor timbers may also serve as clamps to the strings.

Fig. 8. Showing the manner in which the posts, the main and counter braces, and the lower string are connected.

A, B, a portion of the lower string.

C, D, a portion of the post.

E, a portion of the main brace.

F, a portion of the counter brace.

a, a block supporting the lower extremity of the counter brace, *b*, *c*, the key by which the post is kept in close contact with the main brace, and by which the truss frame may be adjusted to its appropriate vertical direction.

Note. The toe of the main brace thrusts against the lower shoulder or step of the post, and the heel against another shoulder behind the block, *a*, as represented in the figure.

Fig. 9. Showing the manner in which the posts, the main and counter braces, and the upper string, are connected.

A, B, a portion of the upper string.

C, D, a portion of the post.

E, a portion of the main brace.

F, a portion of the counter brace.

e, the key at the head of the post, same as *b*, *c*, of Fig. 8.

d, a key passing between the head of the counter brace and the centre string piece, and serving to communicate a thrust or action to the counter brace.

Note. The string pieces, in this and the preceding figures should be so adjusted that the toes of the main braces will be situated at the centres of the former, and their heels at least three inches above the string pieces.

Fig. 10. End views of the post and string pieces projected into each other.

Fig. 11. A view of a portion of one of the strings showing the notches for the reception of the posts.

Fig. 12. A view of a portion of the post showing its neck, or the notches for the reception of the string pieces.

Fig. 13. A view of a portion of the counter brace showing the tongue and shoulder of one end; and the notches for the reception of the main braces.

Fig. 14. A view of the anchor placed in the abutment at B, Fig. 3, to which the iron stay is attached.

Some remarks on the foregoing, by the Patentee.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—I take the liberty to offer for publication, in your valuable Journal, a description of the *Jackson Bridge*, together with drawings explanatory of the manner of its construction, and of the adjustment of its parts.

The only bridge hitherto constructed on this plan, has lately been built on the Washington road, about 2¼ miles from Baltimore, at its intersection with the Baltimore and Ohio Rail-road, and at an elevation 40 feet above the latter. The length or span of the bridge is 109 feet, its width from out to out 24 feet, and its height from bottom to top of its posts, 14 feet. It is supported by a double truss frame on each side, furnished with arch braces beneath only; the upper arch braces not being required in a bridge of that length. The exterior string pieces of each string are only six inches square, and the interior six by eight inches. The posts at the ends, and at the centre of the bridge, as also the arch braces, are of the size last mentioned. The other posts, and the main braces, are six inches square. The counter and lateral braces are only five inches square. The whole of the timber, except the keys, is white pine, with no other seasoning than what it might have acquired in six weeks, during which time the work was in progress, having been framed and raised in that time by six workmen only. Independently of the

LONGS JACKSON BRIDGE

PLATE III

Fig. 1.

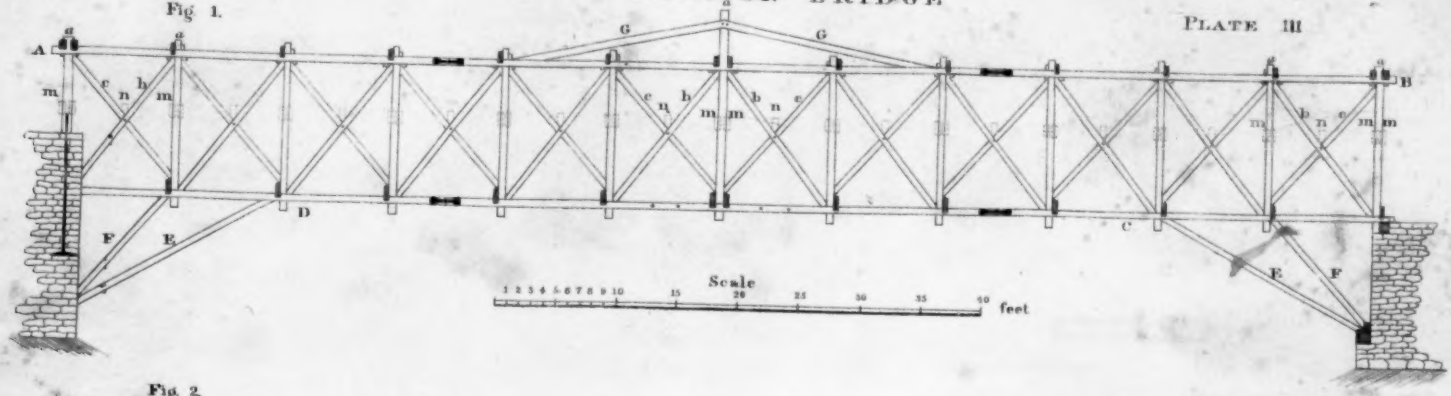
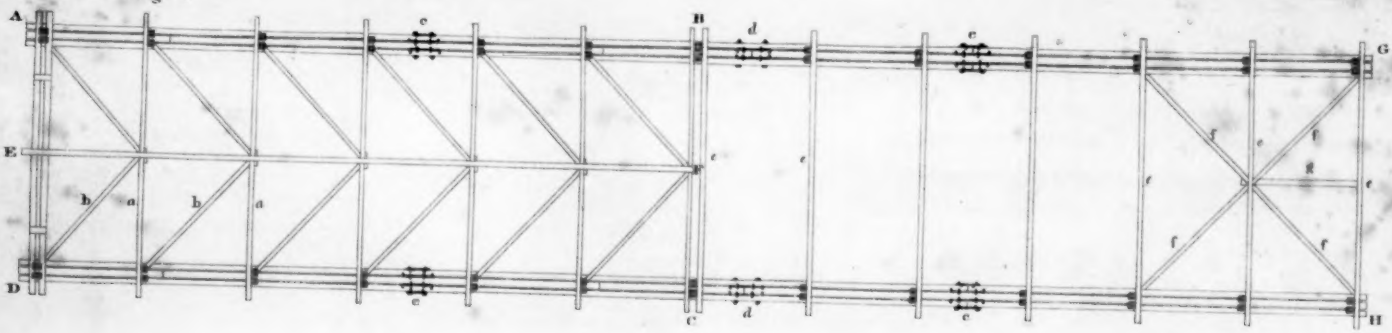


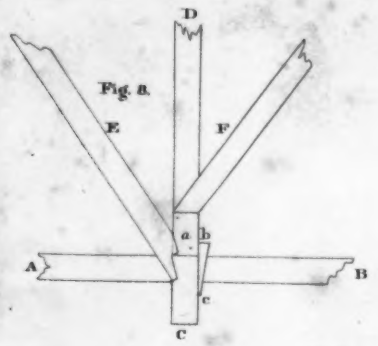
Fig. 2.

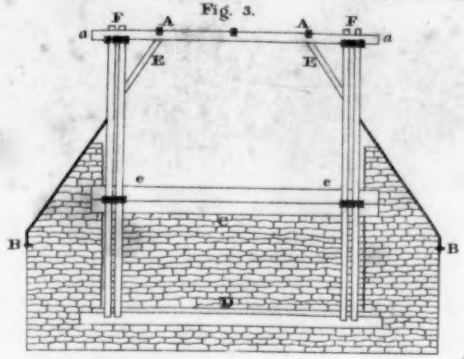


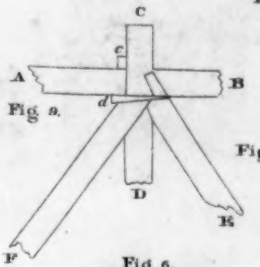
feet

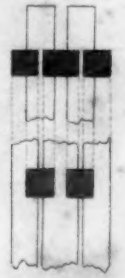
LONG'S JACKSON BRIDGE

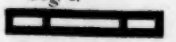
PLATE IIII

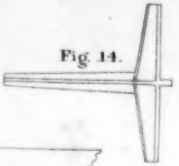


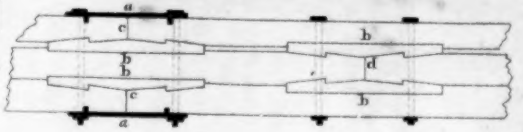


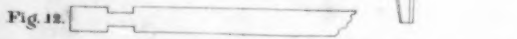


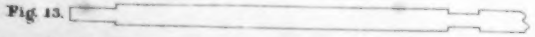


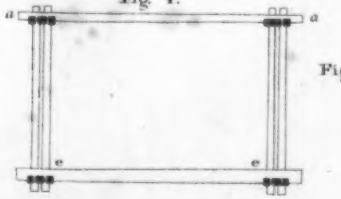


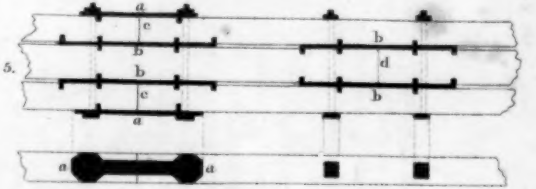


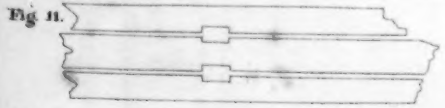




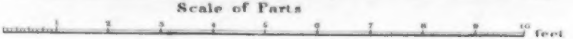








Scale of Parts



abutments and exterior covering of the bridge, its cost, inclusive of materials and workmanship of every kind, was only about eleven hundred dollars.

However slender the materials of which this bridge is composed, and however deficient in strength it may appear, it is crossed daily by stages at full speed, and has actually sustained about eighty beeves, driven across it at once, in close gang, without the least apparent yielding in the truss frames.

Agreeably to the most approved rules for computing the strength of similar structures, it will sustain, on every square foot of its floor, in addition to its own weight, at least 130 pounds, or equally distributed over the entire surface of its floor, about one hundred and ten tons weight.

Very respectfully, yours, &c.

S. H. LONG.

Specification of a patent for apparatus for Grinding, or rubbing down Whet stones, Marble, and other hard substances. Granted to BARTON N. FYLER, *Bradford, Orange county, Vermont, April,* 1830.

To all whom it may concern, be it known, that I, Barton N. Fyler, of Bradford, Orange county, in the state of Vermont, have invented a new and useful apparatus, for the purpose of grinding, or rubbing down, whet stones, marble, and other stones, and hard substances, and which I also mean to apply to the grinding of grain and of other articles which are to be reduced to powder, and also to the clearing or hulling of seeds of various kinds, and also to the grinding to pulp of rags, and other articles used in the manufacture of paper, and I do hereby declare that the following is a true and exact description of my said apparatus.

I make, of any suitable kind of wood, a wheel, or cylinder, which may be in the form of the ordinary mill stone, or of a grind stone, with the end of the grain of the wood forming the surface upon which the grinding is to be effected. When the flat surface or ends of the cylinder are to be used as in the mill stone, the grain of the wood is placed in the direction of the axis of the cylinder. When the periphery is to be employed as in common grind stones, the grain is made to run from the axis towards the periphery, by joining together a number of wedge formed pieces of timber.

I then take pieces of iron, or steel, or of any other metal, generally using pieces of rolled iron about one-eighth of an inch in thickness, about one inch wide, and four inches in length, more or less; these I drive endwise into the end grain of the wood, and even with its surface, allowing a space between them, generally, of one-fourth of an inch, placing or driving them in this manner over the whole surface.

When stone, or other hard substances, are to be ground or rubbed down, I use sharp sand, emery, or other similar article, either with or without water, the hollows or flutes which form in the wood between the strips of metal serving to retain the sand, or other

coarse powder, and to cause it to operate with great efficiency. When I use my combined grinder as a substitute for a mill stone in the grinding of grain, and for other purposes, I give such a form and direction to the pieces of metal as may be thought best to answer the purpose of the ordinary dressing upon such stones; their distance also being varied as judgment or fancy may direct.

The combined grinder is readily dressed or sharpened when used as a mill stone, by running between the surfaces, fine sand, which speedily gives a cutting edge to the metallic strips.

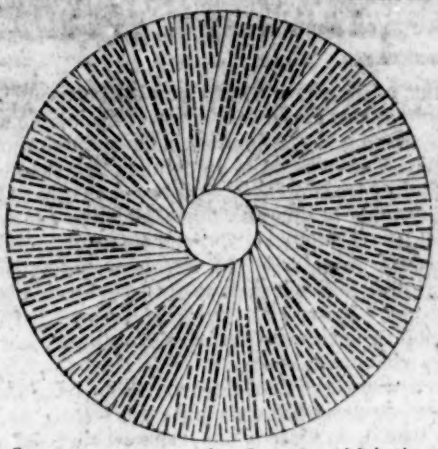
For the grinding or facing of large slabs of marble, I use a wheel of about three feet diameter, with its under flat side formed for the grinding surface; this I attach to the lower end of a perpendicular shaft, which is confined in suitable gudgeon blocks; a swivel joint is connected at the upper end of the shaft, by means of which it is raised and lowered at pleasure, and is put in a revolving motion by any suitable machinery.

Sand and water are applied through apertures at, or near, the centre of the wheel. The marble, or other article to be ground, is carried under the rubber in a level position by a crane of about twelve feet sweep.

The various kinds and forms of marble rubbers now in use, may be constructed on the principle of my combined grinder, and applied in the same manner they have heretofore been used.

What I claim as new, and as my invention, and for which I ask an exclusive privilege, is the formation of a grinding surface, by the combination of wood and of metal; the metal being driven, or inserted, into the end grain of the wood, in the manner and upon the principle hereinbefore described, whether the metal be in the form of strips, or of pins, or in any other shape, and to whatever kind of grinding, a surface so formed may be applied.

BARTON N. FYLER.



The above figure represents the form in which the strips of iron

are driven, as shown in the model deposited in the patent office, but which may be varied as may best suit the intended use.

Remarks by the Editor.—The patentee and his brothers have been long engaged in the manufacture of what are called the "Magog oil stones," and the "Indian pond scythe stones;" the process of grinding them down, formerly pursued, consisted in holding them upon the flat side of a mill stone of about 3½ feet in diameter, made from granite rock, and supplied with water and sand. Mr. Fyler at length thought of the kind of grinder above described, and upon trying it, was agreeably surprised in finding it to operate in a manner so advantageous as greatly to transcend his expectations: he was, in fact, astonished at the success of his own machine.

Encouraged by this success, he was induced to employ a grinder in the rubbing down of marble, and afterwards as a substitute for burr mill stones, in the grinding of grain, and, as he states, with perfect success; his testimony being fully corroborated by others. Many experiments have been instituted, and are in progress, in order to ascertain the best draught of furrows, and the most proper forms, distances or positions of the plates, or pins. This grinder promises to form one of the best, and most economical, hand corn mills; a machine so much needed in many parts of our country.

There is another important application of this apparatus, in the art of grinding, which will probably become the subject of another patent. Upon this point we shall merely observe, that we have received a specimen of the work performed by it, in an experimental essay, and that this specimen is remarkably good; we hope, therefore, to make known this new application, at an early day.

Remarks on the Pendulous Rail-road Car, and on the adapting Rail-way Cars to run on common roads, &c. described in the last number. By the Patentee.

The patentee of the above named cars has been much gratified by the favourable opinions expressed by several scientific and practical individuals to whom he has submitted his descriptions and drawings; they have generally concurred in an opinion, that the Pendulous Car is recommended by its simplicity, and have not been able to suggest any objection tending to diminish the confidence which he has entertained, both of its practicability, and its utility. Some have apprehended that the strength of the wheels would be diminished by their increased size, and that they would be subjected to a considerable lateral strain. It must be obvious, however, that the jolts and shocks sustained by a common cart wheel upon ordinary roads and streets, are beyond comparison more violent, than those upon the level surface of a rail-way; and that, from the load of the Pendulous Car being suspended so much below the axle, the lateral strain will be not only far less than upon those of the common cart, but probably not even equal to that upon the wheels of an ordinary rail-way wagon of 2

feet 6 inches diameter, and where the load is uniformly placed above the axles. The objections, therefore, suggested on this account, were, upon consideration, conceded to be of but little weight.

It is difficult at this period, before actual trial has been made, to say what will be the precise maximum advantage gained in case of draught by the Pendulous Car, but we may, I think, approximate to it with considerable accuracy.

It is generally admitted, that with the ordinary wagons, as perfected in England, with wheels of 2 feet 6 inches, or 2 feet 9 inches diameter, a horse will draw with advantage, about 8 tons weight. It must be evident, therefore, that with wheels of 5 feet, or 5 feet 6 inches diameter, turning upon gudgeons as described in the specification, (in which case, the diameter of these, need not be greater to sustain a given weight, than the axles of four-wheeled cars,) one revolution of the wheels will carry the car double the distance forward—or, in other words, that the same load will be carried towards its destination, with one-half the friction. The dust, and the imperfections, inseparable from the surface of the rails, will be surmounted with equal advantage; and we may therefore conclude, that the horse will draw 16 tons with the same ease upon the Pendulous Car, that he could take 8 tons upon the ordinary wagons, with wheels of only one-half the size. Should the load be supported on an axle, instead of upon gudgeons, the diameter of this must be somewhat increased to give it the required strength, in which case the advantage gained in case of draught, would probably not exceed two-thirds of that when gudgeons are employed—or, that the horse's power would be now about 13¼ tons.

It is not denied, that wheels of larger size, would give equal ease of draught in proportion to their load, to wagons in which four of them would be used; but it is believed they would add so much to the bulk and weight of such a machine, as to render it less manageable and convenient, in practice, for many of the purposes to which rail-road vehicles are applied. A car with but two of the large wheels, will not occupy more room than the wagons as at present constructed, and will afford even greater facility of being turned, or managed in any way at the point of departure or of destination, by the attendant who has charge of the train.

Should the use of friction wheels be found, in practice, to justify the expectations formed by those who have experimented with them, they may be applied without difficulty to the Pendulous Car, and as the horse's power will, as has been shown, be greatly increased without their aid, by the use of large wheels, the additional power gained by the application of friction wheels, must also be multiplied in the same proportion. There will be this further advantage gained in the application of friction wheels to the cars, that but one-half the number of them will be required as for wagons, although of somewhat increased strength, and consequently an important saving will be effected in the first cost.

The cost of transporting heavy articles, and such as are not of much value in proportion to their bulk, as coal, lime, plaster, stone, &c. &c. will be so much reduced by the use of rail-roads, and the

improvements connected therewith, (a single horse and attendant being enabled to conduct a long train of cars or wagons,) that a serious item in the remaining expense, and more particularly for short distances, must arise from the labour of loading and unloading. An important saving will be experienced, in the facility with which either end of these cars may be brought to within three feet or less from the ground, (simply by tilting, and projecting downward the props or supports at the opposite end,) and which will, therefore, require a less disadvantageous lift, than in the common wagons, where the load must be raised 4 feet or more from the ground. It is obvious with what comparative ease, a labourer will operate in lifting but a short distance from the ground, than when the weight is to be raised to a point, which requires the arms to be extended at right angles with the body.

For the adaptation of rail-road carriages to the common streets or roads, the method last described in the specification, viz. by widening the flanch, is particularly well suited to the use of the Pendulous Car. As the patentee proposes in many instances to construct the spokes and felloes of these large wheels with wood, it is but to make the latter of sufficient width, to admit of two treads or surfaces, one of which acting as a flanch to that running upon the rails, will also have breadth and strength sufficient to support the cars upon the common roads or streets. It will of course be requisite, that both the tread and widened flanch, be bound with a suitable tire or rim of iron, to adapt them to their respective functions; but as the joint width need not exceed 5½ inches, the additional size or weight of the wheels, will scarcely be felt by the horse, in proportion to that of the cars and their loads.

The moveable flanch also, offers a quick and ready mode of attaining the same end, by disengaging it entirely from the wheels of the cars or wagons, if so preferred, when they are desired to pass off the rails. On the removal of a single bolt from the flanch, it may be lifted off the buttons or catches attached to the sides of the wheels, and either be suspended to some convenient place on the sides of the cars, or deposited in the vicinity. On their return to the rails, they may be attached to the wheels again with equal facility. The projecting buttons or catches may be tightened from time to time, by half a turn of the nuts, by which they are secure at the opposite side of the wheel.

The patentee indulges a hope, that the ready means described in the specification, by which rail-road vehicles may be converted into such as are suited to our common roads and streets, will not only save the expense of once unloading and re-loading again, into other vehicles at the termination of a rail-road, (which, in articles of great bulk and of little comparative value, would render the establishment of a depot at that point necessary,) but that the entire city in which the rail-road terminates, would now become the depot, and a great public advantage accrue, from each citizen being enabled to load, or receive loading from the cars, at any point that his warehouses or interest rendered the most advantageous.

Samuel T. Jones.

ENGLISH PATENTS.

To Josias Lambert, *Esq. for an improvement in the process of making Iron applicable at the Smelting of the Ore, and at various subsequent stages of the process, up to the completion of the rods or bars, and for the improvement of the quality of inferior Iron.* Dated March 30, 1829.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Josias Lambert, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained as follows, (that is to say:)—

The improvement in the process of making iron applicable at the smelting of the ore, and at various subsequent stages of the process, up to the completion of the rods or bars, consists, in the application of salt and potash mixed or combined together, to the iron ore or iron in the blast furnace, the refinery furnace, the puddling furnace, or the balling or re-heating furnace, or in any other process to which iron in its manufacture is subjected, when considerable heat is applied.

The proportions in which I recommend the salt and potash to be mixed or combined, are two parts of salt to one of potash; but should the proportions in some degree differ from that best adapted to the purpose, the useless portions will be dissipated in the process of the manufacture. The mixture or combination employed during the process in the blast furnace, should be applied at the time of the smelting of the materials, which are to produce the iron, at the rate of about fifteen pounds to the ton of iron; and may be introduced in proportionate quantities at the tunnel head of the blast furnace, either at intervals or with every charge of the materials, which are to produce the iron. If not used in the process of smelting, it may be applied at intervals to the metal during the operation in every charge in the refinery furnace, or in the puddling furnace, or to the iron in the balling or re-heating furnace, or in any other process to which the iron in its manufacture may be subjected, when considerable heat is applied. A proper proportion of the mixture to be used in the refinery furnace, may be at the rate of about twelve pounds and a half to the ton of iron; and in the puddling furnace, about eleven pounds to the ton of iron; but in the balling or re-heating furnace, and other processes, the quantity to be applied must depend upon the quality, form, and substance of the iron, taking care that it is sprinkled over and amongst, or brought in contact with the iron; the quantity will vary from about ten pounds to twenty pounds per ton.

The quantity to be applied will differ in some degree, according to the quality of the materials or the iron; but the proportions above mentioned, are about those proper upon the average.

The process for the improvement of inferior iron, consists, in the application of the same mixture in similar proportions to such iron,

when subjected to considerable heat. For this purpose the mixture may be applied to the iron, and the iron melted in combination with it; it may be applied to the iron in any re-heating or other furnace, and the metal then be subjected for a time to a red heat proportioned to the quality, form, and substance of the iron, care being taken that the mixture be applied in contact with the heated metal; and for this purpose, if the iron be in the form of tubes, such as gun barrels, the mixture may be introduced into the tubes.

Although I have mentioned common salt and potash as the substances to form the mixture to be applied, there are other compounds of sodium and potassium, which may respectively be substituted for those materials, which will have the same effect, so that the bases in the compounds are combined together, but I recommend the salt and potash as being the most convenient and economical.

In witness whereof, &c. [*Rep. Pat. Inven.*

To CHARLES SANDERSON, *Iron Master, for a new method of making Shear Steel.* Dated September 4, 1828.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Charles Sanderson, do hereby declare the nature of my said invention, to consist, in forming shear steel out of very small pieces of bar steel, instead of pieces from one to two feet in length, as heretofore, whereby I am enabled to form shear steel with fewer heats, and, consequently, with less waste, and without the use of silicious sand, as heretofore practised. And in further compliance with the said proviso, I, the said Charles Sanderson, do hereby describe the manner in which my said invention is to be performed, by the following description thereof, (that is to say:)—

I take bar steel in the state in which it comes from the converting furnace, and break it into very small pieces of one inch to two inches long, a quantity of these small pieces being ready, I procure a round stone, of any quality which is capable of withstanding the strong heat of a reverberatory furnace, without cracking or breaking, and upon this stone the small pieces of steel are piled as closely and compactly as possible; the whole is then inclosed in a fire clay crucible, and placed in a reverberatory furnace, where it is allowed to remain until the whole mass becomes of a high welding heat; it is then taken from the crucible and placed under a heavy cast iron hammer, usually called a metal helve, and exactly the same as those used in the manufacture of bar iron; this hammer is driven by machinery, and from the circumstance of the whole mass being in a semi-fluid state, it is almost instantaneously hammered or manufactured into one solid mass or bloom of steel, of from three to four inches square; this bloom is placed in a furnace, or as it is more generally termed, a hollow fire, of two or three feet square, heated with coke, and the heat increased by the application of a blast of air, and the whole mass or body of the steel so hammered or manu-

factured as aforesaid, is raised to a high welding heat; it is then taken from the furnace and placed under the same metal helve or hammer before mentioned, and drawn into a bar of shear steel, ready to be tilted or rolled into the various sizes or shapes which may be required. For shear steel to be used for inferior purposes, it might be too expensive to place the piled steel in a crucible, but it might merely be placed in a reverberatory furnace, and drawn thence when it is of a complete welding heat. Shear steel made in this manner being very superior in quality to that made in the ordinary way, and the process herein described causing much less waste than that heretofore adopted, I hereby claim as my invention, the said process or method of manufacturing shear steel; and such my invention, being to the best of my knowledge and belief, entirely new, and never before used within that part of his said majesty's United Kingdom of Great Britain and Ireland, called England, his said dominion of Wales or Town of Berwick upon Tweed. I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects fully and without reserve or disguise with the proviso in the said hereinbefore in part recited letters patent contained; wherefore I hereby claim to maintain exclusive right and privilege to my said invention.

In witness whereof, &c.

Observations by the Patentee.—It might be well to observe, that the *cost* to the consumer of shear steel will be very much *decreased* in consequence of the facility afforded by making it in the patent way. The steel must of necessity be much better, as in this process it is subjected to less heat, and consequently less liable to be what is technically termed "burnt." From the large quantity of this kind of steel used by the Sheffield and Birmingham manufacturers, the discovery must be of great use to those towns, and it is wished that no prejudice may exist against the new mode (in consequence of its difference from the old one,) but that it may be submitted to an unprejudiced trial. [*Ib.*

To JAMES GRIFFIN, *Scythe Manufacturer, for an improvement in the manufacturing of Scythe Backs, Chaff-knife Backs, and Hay-knife Backs.* Dated April 26, 1828.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said James Griffin, do hereby declare, that my invention is fully described and ascertained by the following description thereof, (that is to say:)—

My invention consists, in forming scythe backs, chaff-knife backs, and hay-knife backs, with raised studs or pegs, for the purpose of rivetting the cast steel blades thereto, and which studs or pegs form part of, and are solid with the said backs. In order that my invention may the better be understood, I will first describe the manner

at present in use for making backs, and then proceed to describe my improvement, whereby my invention will be readily understood, and so that a person conversant with the manufacturing of scythe backs, chaff-knife backs, and hay-knife backs, may be able, from this my specification, to make and execute my invention. The usual manner for forming the backs for cast steel scythe blades, is by welding, or making a piece of iron into the shape required, and then by drilling, or by some other means, forming holes at proper distances; which holes are for the purpose of receiving the studs or pegs by which the blades are rivetted to the backs; now it is evident that the backs thus perforated must be considerably weakened, as in each place where a hole is formed there is nearly a third of the width of the metal removed.

The object of my improvement, is, to construct the backs with raised studs or pegs which are solid with the backs; consequently backs so formed, will be found much stronger than those which are perforated for passing the studs or pegs through for the purpose of rivetting on the blades. The manner I have found to answer best for making backs according to my improvement, is, by passing of iron (or other proper metal,) heated to a welding or proper heat, through a pair of rollers prepared in the following manner:—

I cut a groove around the circumference of one of the rollers to the size and shape required, and sink small holes at proper distances, so that when the heated iron (or other proper metal,) has passed between this grooved roller and a plain roller, it will come out with raised or projecting studs or pegs on one of its surfaces, which studs or pegs are formed by the metal being passed into the sunk holes. The end of the back is then to be formed by welding and forging it to its proper shape, and the back is to be cleaned by rough filing, and will then be ready for having the blade riveted thereto, which is done by beating down the studs or pegs, and making them spread over the holes formed in the blade. I have here only described my improvement as applicable to a scythe back, and have to add, that the same description will apply to chaff-knife backs, and hay-knife backs, they differing only in shape. I have also advised the making of the backs by means of rollers, considering that to be the best and most perfect manner of forming them; but I would have it known, that I do not confine myself to that method, but would have it understood, that I consider my invention to be, and limit my claim to, the forming or manufacturing the backs of scythes, chaff-knives, and hay-knives, with raised studs or pegs, which form part of, and are solid with such backs. [*Ib.*

To WILLIAM STOREY, *Plumber and Glazier, and* SAMUEL HIRST, *Clothier, for certain materials, which when combined, are suited to be employed in Scouring, Milling or Fulling, Cleansing and Washing of Cloths and other Fabrics, and by the employment of which material considerable improvement in those processes is effected.* **Dated March 10, 1829.**

THESE materials consist of a saponaceous mixture, compounded of alkaline matters, with a small quantity of fat, and the following method of preparing it, is nearly a verbatim copy of the specification.

A large cistern being procured and filled with human urine, the latter is allowed to stand in it for about six weeks, in order to produce fermentation; when this has thoroughly taken place, about four hundred gallons of the fermented urine is to be transferred to an iron still, with a block-tin worm passing through a refrigerator, of the usual construction; to this is to be added one pound of tallow, prepared from beef suet, for the purpose of preventing the froth that would otherwise arise in ebullition. This mixture is to be distilled, and whilst in operation, about six gallons of the aqua ammonia thus produced, are to be drawn off into a cask, adding six pounds of the best mottled soap, previously dissolved. This will give it an opaque appearance, and produces, as the patentee asserts, an excellent saponaceous material for cleansing and dressing woollens. The casks should be bunged up to exclude the air. [*Ib.*

To THOMAS ROBINSON WILLIAMS, *Esq. for improvements in the making or manufacturing of Felt, or a substance in the nature thereof; applicable to the covering the bottoms of vessels, and other purposes.* **Dated May 21, 1829.**

THESE improvements consist in passing the hair, wool, cotton, hemp, or other material intended to be manufactured, between two endless webs of woven wire, immersed in tar or pitch, in such manner that only a proper quantity of the latter shall be imbibed; and also by the use of glue or size, instead of tar, &c. in forming a material which may be used for mill-board, paste-board, and floor-cloth.

The machine the patentee uses for these purposes, consists of a vessel for containing the pitch or tar, which is placed on a frame, and is heated either by coils of steam pipes placed within, or by a fire immediately below it. Near one end, and immersed in the liquid contained in the vessel, is a roller, under which a web of woven wire passes, for conducting the felt through it, and towards two pressing rollers placed near the other extremity, but above the liquid; another web of wire passes under the upper one of these, and the two webs having rotary motion imparted to them, convey the felt through the pressing rollers, in order to squeeze out all the

superfluous tar, which drops again into the vessel, while the felt is conveyed off to a table, where it is then ready to be cut into sheets, or whatever form may be required. A series of conducting rollers are used for facilitating the admission of the felt. The patentee does not confine himself to any particular machine for spreading the material, but states, that either a carding engine, blowing machine, or devil, may be used for that purpose. [*Ib.*

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held on Thursday evening, February 25, 1830.

Mr. William Neal, was appointed chairman, and

William Hamilton, Recording Secretary, *pro tem.*

The minutes of the last meeting were read and approved.

Mr. Edward G. Dorsey presented the *History of Pennsylvania, from its Discovery by Europeans, to the Declaration of Independence in 1776, by Thomas F. Gordon.*

The corresponding secretary stated that owing to the obstruction of the Delaware by ice, the European exchanges had not been received during the past month.

Professor Johnson, of the committee on inventions, reported that the committee had prepared a report on Mr. Woodward's machine for Planing and Grooving Boards, but the patentee having removed the model for a short time, they declined presenting the report until the next meeting, at which time the model will be returned and submitted with the report.

Mr. Charles Potts submitted a paper in reply to the query referred to him at the last meeting, viz. what is the difference between the absolute efforts employed to move a locomotive engine, when the force proceeds in one case from the engine itself, and in the other, from a stationary engine, supposing the plane over which the motion takes place to be horizontal? which was read, and after various remarks, was referred to the committee for publication.

The committee on subjects for discussion, submitted the following, which were accepted and referred, viz.

What is the best unguent, and the most economical mode of its application, to diminish the friction of rail-way cars, locomotive engines, and other machinery of a similar construction?

What is the best method of proving, experimentally, the force of percussion?

What is the best mode of measuring the energy exerted by mechanical movers, while the machinery impelled is in motion?

Extract from the minutes.

William Neal, *Chairman.*

William Hamilton, *Recording Secretary, pro tem.*

Reply to the question, What is the difference between the absolute efforts employed to move a Locomotive Engine, when the force proceeds in one case from the engine itself, and in the other from a stationary engine, supposing the plane over which the motion takes place to be horizontal? *By* Mr. Charles Potts. *Read at the meeting held February* 25, 1830.

TO THE FRANKLIN INSTITUTE.

With regard to the efforts of a stationary and of a locomotive steam engine in producing motion along a horizontal plane, allowing the powers of the two engines to be equal, and that the operations of the locomotive engine can be performed with the same regularity and freedom when travelling as when fixed and stationary; allowing also that the friction of the wheels of the locomotive carriage on the rails is fully adequate to the power of the engine, it must be obvious that the absolute difference between the efforts of the two engines will on the one hand be commensurate with the difference between the amount of friction due to the weight and motion of the chain or rope necessarily appended to the stationary engine, and constituting part of it; and on the other, to that of the friction due to the weight and motion of the locomotive engine itself. When these, therefore, are equal, the absolute efforts of the two engines on the horizontal plane will of course be equal. Hence, also, it may be inferred that on a horizontal rail-way of considerable length, the locomotive carriage must have the advantage decidedly.

This question, however, is intended to embrace more particularly the difference between the efforts of stationary and locomotive *animal* engines.

When a horse, for instance, draws the carriage after him, as in the ordinary mode of tracking, or when his efforts exerted in the same manner are employed at some fixed point of the horizontal plane to turn a drum, from whence, by means of chains or rope, his power is transmitted, then we have the case of a stationary engine; but when the horse is compelled to travel on an *elastic inclined plane*, mounted on the carriage, and by the joint efforts of gravity and his animal powers, urges the carriage forward, we have that of the locomotive engine.

Now in order to determine which of the preceding methods of applying the action of the horse, would be most advantageous in propelling the carriage along the plane in question, we shall first consider the manner and measure of his force, when his efforts are employed as in the first of the foregoing cases answering to that of a stationary engine, viz. when drawing the load after him along the horizontal plane.

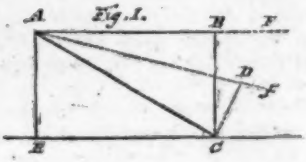
It is to M. Deparcieux that we are principally indebted for correct information on this part of our subject. He has shown in the most satisfactory manner that animals draw by means of their own *weight*, and not by the force of their own muscles, as some have

contended. This supposition which renders their action entirely mechanical, will enable us more readily to subject their efforts to mathematical investigation.

The hinder feet of the horse are considered the fulcrum of the lever by which his weight acts against the load. The length of this lever being equivalent to the distance between the centre of gravity or chest of the horse and the hinder feet.

Thus in Fig. 1, suppose the load attached at F, the line of traction AF, and that BC represents the hinder leg of the horse, AB part of his body, A, his chest or centre of gravity, and CE the level road. Then ABC will represent the crooked lever by which the horse acts, which is equivalent to the straight one, AC.

Fig. 1.



Now when the animal lowers his centre of gravity, which he always does when he pulls hard, his weight acts downwards at A, round C as a centre, and drags forward the load at F. Hence on the principle of the bent lever, CE will represent the power of the lever in this position, or the lever of the horse's weight, and CB the lever by which it is resisted by the load.

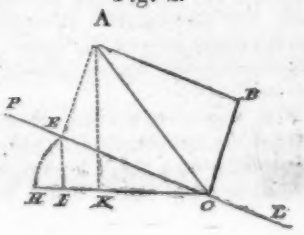
M. Deparcieux found, experimentally, that the most favourable position of the traces, or the *line of traction*, was obtained when the angle BA*f* was fourteen or fifteen degrees.

From the above illustration, it may be inferred that *large horses will draw more than small ones, even though they have less muscular force, and are unable to carry such a heavy burden.* The force of muscles tends only to make the horse carry continually forward his centre of gravity, or in other words, the weight of the animal produces the draught, and the play and force of the muscles serve to continue it.

Suppose now the horse is made to ascend the inclined plane, as in the case of the locomotive engine already defined. It is evident that as the inclination of the plane increases, the power or lever of his action will be diminished. Hence, in order that the whole amount of his mechanical and muscular force may be kept in equilibrium, we must suppose his muscular force to have been increased in the same ratio. This supposition, however, it is clear, is perfectly inadmissible, inasmuch as we suppose an equality between the absolute powers of the two engines in question.

Let PL (Fig. 2,) represent the inclined plane upon which the horse is supposed to travel. From A, the centre of gravity of the horse, let fall AK perpendicular to the horizontal line, CK. Then will CK represent the mechanical effort of the horse to urge the plane from P to L. The force or action of the horse on the plane, which

Fig. 2.



arises entirely from the gravitation of his weight, will be as the sine of the angle of inclination; that is, as EI. This quantity is also equivalent to the difference of the muscular force which the animal must exert when travelling up the inclined plane, and when moving on a horizontal one, so that when the absolute powers of the stationary and locomotive engines are equal, we shall have the absolute efforts of the first to the latter, as CE or CH to CK.

Even allowing the quantity EI to be added as a force due to the inclination of the plane, it is sufficiently obvious that the *resultant or sum of the two forces* must always be *less* than that due to the force of the animal alone when employed in dragging the car after him, as in the ordinary mode of tracking.

Very respectfully,

CHARLES POTTS.

February 25, 1830.

On the pressure exerted upon an Inclined Plane, by a Descending Body. *By* THOMAS W. BAKEWELL.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—If you do not think the question of pressure on an inclined plane, by a body in motion, exhausted, please give the following a place in your Journal, as àpropos to the subject.

Bernoulli showed by experiments before the Academy of Petersburgh, that when water moves with any velocity in a canal, the pressure which it exerts on the bottom and sides of the canal is less than when the water is at rest; and that the pressure decreases according to the velocity. Bossut has obtained similar results, and M. Romme, in his "Art de la Marine," gives the results of experiments showing the decrease of pressure on the bottom of a vessel floating in water, by the velocity of the current, and arrives at the value of this decrement by experiments with a tube or tubes, open at both ends, one end of which is immersed to a given depth in water, with a float resting on the water, inside the tube, to which is affixed a rod, or scale, rising above the upper end of the tube.

The integrity of the above authority, we have no right to doubt; but the correctness of the results of the experiments, at least from the cause assigned, is very questionable.

If we suppose a circular trough, containing water, and balanced in scales, the water being at rest, I think it is not hazarding much to say that no alteration of weight would be discovered by any velocity we might give to the water. Otherwise, a mill stone in motion does not press on the spindle in the same degree as when the stone is at rest.

With respect to a vessel sinking deeper in a current than in still water, I am not prepared to answer in the negative. The roughness or asperities on a ship's bottom, will, in a current, create a coating of dead, or eddy water, which may produce the alleged effect; but

the dead, or eddy water, is caused by its deflection from a line parallel to the bottom of the ship, the reaction of which, on the ship, would, I should suppose, be equal to the loss of pressure by the deflection.

I am the more inclined to believe that the experimenters have been deceived, from the circumstance of the sinking of the water in the immersed tube, having been taken as a test applicable to the vessel. The water would be deflected downwards by the end of the tube, leaving a space of eddy water at its mouth in contact with the passing current, which by its cohesion, or friction, (or both) would diminish the quantity of water under, and in the tube.

An error might also arise in ascribing the increased height of the water, shown on the stern post (a fact which always occurs) to a diminution of pressure on the bottom, whereas it is owing to the momentum of the water following the rising lines, as they lead to the transom and stern post.

That the motion of a body on an inclined plane, does not affect the pressure, has been conclusively demonstrated by several writers in this Journal; permit me, nevertheless, to exhibit another view of the case.

Fig. 1.

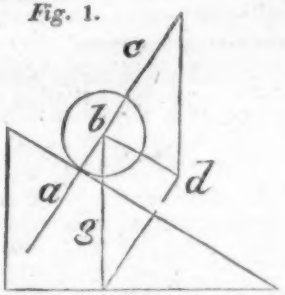
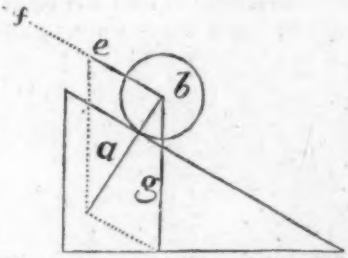


Fig. 2.



Let the height of the plane, Fig. 1, represent the weight of the ball, *b*. It is then assumed that the pressure of the ball is perpendicular to the plane, and is, in intensity, represented by *a*, = to the sine of the angle of inclination making the base radius. Now if we consider this force, *a*, represented by an equal force in an opposite direction, as *c*, and draw the line, *g*, equal to gravity, we have two sides of a parallelogram, which may be completed, as in the figure, and the ball will be urged in the direction, and with the force of the diagonal, *b*, *d*. I conceive that in the solution of this problem, it is only necessary to prove that the direction of the ball, by the operating causes, would be parallel with the plane; when this fact is established, the variation of pressure by velocity will not, I should think, be a question, and that this would be the case, is evident by our being able under the forces, *c* and *g*, to remove the plane, when the ball would continue to move freely in the direction of the diagonal, *d*, and parallel to the plane.

I observed that the direction and value of force *a*, Figs. 1 and 2, were assumed. We arrive at this force by considering the ball at

rest, *g*, being gravity, Fig. 2, and *e*, the force to prevent its rolling down the plane, which is sustained in a parallel direction, as *e*, *f*. *a*, is the diagonal of the two forces, *e* and *g*, and is compounded of them.

Now the question arises, is the ball under the same conditions with respect to the plane when detached from the sustaining force, *e*, *f*, as when held by some resisting object in the direction, *e*, *f*, by a force equal to *e*? If we cut the supposed line, *f*, and leave the ball free on the plane, does the force, *e*, exist? If not, *a* will vanish, and the plane be pressed only by the force and direction of *g*, and so of all planes, however inclined, or horizontal. I reply that the conditions of the ball are the same, and that the force, *e*, or resistance to its descent, exists in the inertia of the ball.

For let the length of the plane be to the height as 8 to 4, the weight of the ball 4, then a force equal to 2, parallel to, and up the plane, is required to sustain it against the force 2, by gravity down the plane. The force 2, by gravity, is a *constant force* down the plane; but no force can exist, without an equal resistance; there is no cause of resistance but by the inertia of the ball, therefore the inertia of the ball is that resistance.

Again, place the plane, with the ball on it, in a balance; let the plane be prevented from moving horizontally, but perfectly free to move vertically (up or down,) suppose the ball, as before, to weigh 4 lbs., then a line attached in the direction *e*, *f*, to a resisting object, not connected with the plane, and drawing with a force of 2 lbs., will take off 1 lb. from the whole weight shown by the balance. Query, will the whole weight on the balance remain the same if the line *e*, *f*, be cut, which took off 1 lb.?

I reply in the affirmative.

I have always defined inertia to be "that property in matter which causes a *resistance* to change, either of rest or motion. The term resistance has been objected to, as of too active, or positive, a signification. The "passiveness" of matter has been urged in its stead as better conveying an idea of this property.

I have no wish to dispute about terms, and will, therefore, apply the words passiveness and resistance, in contrast, when we shall be better able to decide on which is the most apposite.

We will suppose inertia, and also gravity, constant quantities at the earth's surface; a body will fall say 16 feet in 1″ of time, and acquire a velocity at the end of the time of 32.

Let inertia remain constant, but gravity be decreased one-half, then the body will descend only 4 feet in 1″, and the velocity at the end of the time be 16.

But we can suppose gravity to be the same as at first, and inertia to be doubled, then the body being twice as "passive" (resisting) will only fall 4 feet in 1″, and the velocity at the end of the time be 16, as in the last example.

We can again suppose gravity constant as at first, and inertia diminished one-half; the body in this case, having lost one-half its

"passiveness" (resistance,) would fall 64 feet in 1", and have acquired a velocity at the end of the time, of 64.

Hence it would follow that if matter were entirely divested of this property called inertia, a body would be attracted through any space, however great, without time, an absence of resisting media being supposed. But as inertia now exists, we find that matter at rest is brought to given velocities in the ratio of the power applied, multiplied into the time of its acting, and that matter in motion is reduced to rest, by an opposing force in the same ratio.

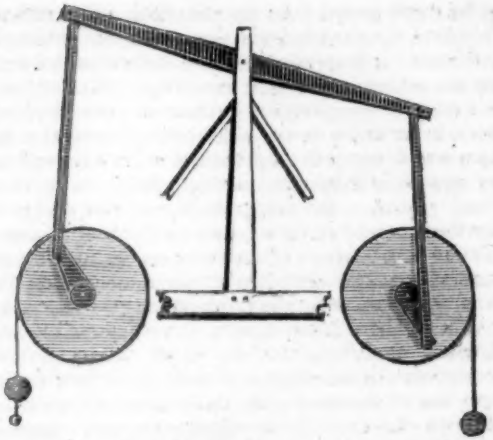
Cincinnati, February 13, 1830.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Computing the Power of High Pressure Steam Engines, with remarks on a former article upon that subject.

Mr. Editor,—Some time ago a friend of mine showed to me a piece in your Journal about the computing of power of high pressure engines. I could not understand much about the calculations, because they were nearly all made with letters, instead of figures, which is a method that but few of us old engineers understand, which, however, may be very useful to young engineers, as they have mostly better opportunities of school learning than we had in old times. In some parts of his piece the author has given his opinions, in part, in writing, which I understand better than I could his calculations with letters. He says, when the piston moves with "one-third of the greatest velocity with which it is capable of working, then will the work done be a maximum, or the greatest possible." To prove this, he states a case where a less pressure on the piston has given more power in a given time, by one-third, than a greater pressure gave in the same time, with a slower motion; this certainly shows that the same engine will do more work in the same time when the piston moves fast than when it moves slow, but it does not show that it will do more work with the same quantity of steam, which I suppose is what he wants to prove by these letters; for at any rate it will be of more value to show how to do the most work with the same steam, than to show how the most work can be done with an engine, without regard to the quantity of steam; for every body knows that the faster an engine runs, the more work it will do in a given time if it be fully supplied with steam, and every body knows also, that the faster an engine runs the more steam will be required to run it. If I understand our engineer, he thinks, and tries to show, that when the piston is moving so fast that 150 pounds of steam in the boiler can press the piston no more than 100 pounds, that this is a better way to work the engine than when the 150 lbs. in the boiler will press the piston 149 pounds; this I don't think he has shown, nor do I think he can show it in any other way than by his letter calculations, which is to me no better than not showing it at all. I have always thought that there was a waste of power (or of steam, which is the same thing) when the force on the piston is not nearly as great as it

is in the boiler; for any body can see that if you open the throttle valve so little that the steam will only press the piston 10 lbs. when there is 150 lbs. in the boiler, and just before the stroke is finished, the valve is opened so far that the steam will flow in and fill the cylinder with 150 lbs. pressure by the time the stroke is finished, that there will be just as much steam used as if the opening had been large the whole time, and the piston pressed 150 pounds the whole distance; now something like this takes place when an engine runs so fast that 150 lbs. in the boiler, at the middle of the stroke, can only press the piston 100 pounds, for as the piston comes near the end, the motion becomes very slow, and gives time for the steam to flow in and fill the cylinder with the steam much over 100 lbs. most of which must be wasted. This engineer also shows by his letter calculation, that there is one-fifth of the power lost by the "nature of the crank motion," and in the "lever beam construction," the loss is more than one-third; now I think if he would apply what he calls his formula fairly to the crank, it would show him that he has not applied it rightly. If he will divide the cylinder lengthwise into four, or any other number of equal parts, and multiply the force on the piston by each one of these parts, beginning at one end, he will find the quantity of power, which acts on the crank and tends to turn the shaft, to be the same for each division of his cylinder; for the connecting rod always presses with the same force on the crank, and the quantity of force applied to the crank in each division of the cylinder, will be found by multiplying the force by the distance the connecting rod has moved the crank in the circle, and the tendency of this force to move the shaft round, will be in proportion to the different leverage at which the force acts. When the piston comes to move through the middle division of the cylinder, the rod will press the crank with the same force as before, but it will not be moved through so large a part of the circle, and will have a greater tendency to move the shaft round than before, because it will act on a longer lever. I am therefore sure his letter calculation, if properly made, will show him that there is no loss in the crank motion, nor even in the lever beam, except what arises from friction. If, however, he cannot satisfy himself in this way; if he can persuade the Professor of Mechanics, Mr. Johnson, (I believe is his name) to make a machine something like the figure in this paper, and try it with weights, he will find that any weight that will turn it part of the way round, will turn it entirely round, and keep it going round as long as the weight acts; if this should be the case, and he shall be still of the opinion that there is a loss of power in one of the cranks, he must also hold the opinion that the other one is a gainer of power. In order, however, to satisfy himself that both ends of the lever beam, as well as both the cranks, are alike in effects as well as in appearance, he may hang the small weight first on one pulley, which it will turn, and then on the other; if they both turn alike, and he still be not convinced, I know not "where, how or when" he will be.



Let the wheels be pulleys, with a cord wound round each, and equal weights fastened to each cord, the wheels, cranks, and beam, would be held still in any place they may be put, but let the small weight, seen at the bottom of one of the large ones, be heavy enough to overcome the friction of the machine, and the whole will begin to move, neither easier nor harder, faster nor slower, on account of the different places of the cranks. So then, the machine will be at work with all the "natures" belonging to the crank; the weight going down takes as much up, except the small weight which is equal to the friction only. AN OLD ENGINEER.

Abstract of a lecture on the Manufacture of Pins, delivered by Dr. BIRKBECK, *at the London Mechanics' Institute.*

IN a recent lecture of Dr. Birkbeck's, at the Mechanics' Institute, while pointing out the advantages to be derived from the use of machinery as a substitute for human labour, he adverted to the various processes employed in the fabrication of a pin. He observed:—

"It has been stated that no less than eighteen individuals are employed in the manufacture of this little implement, some have extended this number to twenty-five, but they must have included processes which occur previous to the drawing of the brass wire. The manufacture of wire, by drawing it through a steel plate fixed perpendicularly on a table, is supposed to have originated at Nuremburg or Augsburg, in the fourteenth century, but the present mode of drawing it through a steel plate, by the addition of revolving cylinders, urged by horses, water, or steam, is of comparatively recent invention. This draw plate is pierced with a number of conical holes of different sizes, the size of the smaller orifice determining the diameter of the wire, which is seized by a strong pair of nippers, and forcibly drawn through these holes when the plate is

placed on the draw frame. As the pin maker requires a very small shaft for his pins, the wire is made to pass through the smallest holes in the draw plate; it then requires to be made straight, and the business of the pin maker commences by cutting it into lengths sufficient to make six pins." One of these steel draw plates was exhibited to the audience, after which it was placed on a draw frame, and a piece of thick wire was dragged through several of its orifices in succession, and was elongated in proportion to the diameters of the holes through which it had passed. By this process the wire became so much heated that the lecturer could scarcely hold it, and he observed that, "the evolution of heat arose (as in the operation of hammering) from the approximation of the particles of the metal by the violent pressure it had undergone, which had forced out its latent caloric and rendered it sensible. Lord Bacon, according to his view of the nature of heat, concluded, that the rapid change of temperature, which accompanies hammering, was occasioned by a rapid vibration of particles; but in drawing wire, there is no vibration at all commensurate with the quantity of caloric evolved. Gold and silver wire, after undergoing this process (which does not diminish malleability or ductility) is frequently flattened, by passing it between two steel cylinders revolving very near to each other: this was a very important improvement, as the fine and costly wire used in forming gold lace is made to cover three times as much space as if in a cylindrical form.

"The boy who points the pins, takes about a dozen of the lengths of wire in his hand at once, and a spectator is astonished by the dexterity with which he contrives to keep them all revolving on their longitudinal axes, while he applies their extremities, first to a coarse grinding stone, and then to a finer one, revolving near the other on the same axis, to give them the necessary polish. The revolution of the wires is necessary to prevent the ends from being ground flat, and so rapidly is the operation performed, that a boy will point 16,000 pins in an hour. As soon as the two ends of the wire are pointed, a pin is cut from each extremity, and the pointing is repeated till six pins are cut from each wire.

"The process of making the heads of pins, or, as it is termed, head-spinning, consists in causing a finer wire to revolve with great rapidity round a straight piece of wire of proper diameter, which is afterwards drawn out, leaving the spiral coil in the form of a hollow tube, which is then cut into pieces, every two rounds of the wire making one pin's head. The heads are then put into an iron pan, and made red hot to soften them, after which they are ready for use; and the next important point is to fix them properly on the shafts. In the year 1543, it was enacted by statute 34 and 35 of Henry VIII., cap. 6, 'That no person shall put to sale any pins but only such as shall be double headed, and have the heads *soldered* fast to the shank of the pins, well smoothed, the shanks well shapen, the points well and round filed, canted and sharpened.' But in our times, no man could get a living at pin making, if he had to *solder* the heads on, or fix them by riveting. All that is now required is

for a boy to thrust the shaft of a pin amongst the heads, and catching one of them on its extremity, he fixes it firmly by striking it with a hammer on an anvil with a small hole in it. This is done with surprising rapidity, and the principal cause of the firm adhesion which takes place between the head and the shaft, appears to be the attraction of cohesion allowed to operate by the closeness of contact.

"When the pins are thus completely formed, they are whitened, placing them in a vessel containing a solution of grain tin in tartaric acid, or the lees of wine. In this process we have an advantage, as to brilliancy of surface, over the continental pin makers, who use lead and mercury instead of tin; and it is said, likewise, that on this account, a puncture from a British pin is of much less consequence than when made with a foreign one. The pins, when thus whitened, have still a dull appearance, which is removed by agitating them in a tub containing bran; and the pins being thus polished by friction, the bran is detached by winnowing, exactly as chaff is separated from grain. The pins are then ready for the final process of papering, an operation not easily understood, as to the mode of folding the paper and the rapid introduction of the pins, without seeing it actually performed."

Dr. Birkbeck unfolded a paper containing four hundred and three common pins, and stated, "that after paying all the expenses of wire, labour, &c. incurred in the processes just described, the whole sum charged by the wholesale dealer, from whom they were obtained, for this quantity of pins, amounted to no more than *two-pence farthing*. They are, therefore, sold in the first instance, at the rate of forty-four and a fraction for *one* farthing, producing, consequently, somewhat less to the manufacturer; and it may be asked, if pins are so cheap, what necessity is there for the aid of machinery in manufacturing them? If the question referred only to the consumer, the answer must be, "none." It would seem, indeed, from the smallness of the price of pins, either that the capitalist must lose by making them, or that his workmen must be miserably paid for their labour; and it appears from a statement published in 1813, respecting the state of the pin trade at Gloucester, where one thousand five hundred hands were employed in it, that the trade was scarcely worth following. Here then the improvements of machinery ought to apply, as not only affording opportunities for a more advantageous investment of capital, but as producing a superior manufacture of the article in question." The lecturer here produced another paper of pins, containing four hundred and eighty, which were sold for *ninepence half-penny*, or at the rate of about twelve and a half for a farthing. In this sample, as well as in several other specimens of patent pins exhibited to the audience, the perfection of the heads enabled the manufacturer to obtain a better price; for the great difficulty in pin making is to fix the head firmly, and in regard to what may be called the machine made pins, without leaving it in a ragged state.

"There is a large manufactory on the Surrey side of Blackfriars' bridge, where pins are made by machinery; and if this establishment, which could supply the whole consumption of the nation

(estimated at *sixteen millions* of pins per day,) were in full action, it may be inquired, what is to become of all the operative pin makers? The answer to this inquiry is, that they must have recourse to other employments, and, driven from this starving occupation, it is probable they would find another, more productive as to wealth, and less oppressive as to labour. The manufacture of ornamental pins, will probably furnish employment for many of the hands hitherto devoted to the production of common pins; and other arts, no doubt, connected with purposes useful and ornamental, will gradually offer to them other resources."

As an article somewhat resembling in its origin a pin's head, and perhaps suggested in the first instance by bits of the spiral coil before described, the lecturer mentioned a simple ornament, the *spangle*. The plan of making this little embellishment of dress, was long confined to the individual by whom it was invented, who made a considerable fortune by the contrivance. It would naturally be imagined that spangles are cut out of a thin plate of metal by means of a hollow punch, and the hole in the centre of each made by a solid punch: but in reality they are formed of a circular portion, or single ring of wire, which being laid upon an anvil, and struck with considerable force, is extended in all directions equally, and converted into a flat ring with a small hole in its centre, or into a spangle; at the same time that an almost perfect junction of the two extremities of the ring of wire is effected by the cohesive attraction there brought into action, as was described to occur in fixing the head of a pin.

"It may be presumed then, that no more damage will result from the application of machinery to pin making, than to those employments in which human labour is too laborious; an example of which is seen in the dreadful toil of the men who heave the coals from vessels lying in the river, into the barges alongside. Many of these men are preparing for death at the age of thirty-five; for the unnatural state in which the surface of their bodies is kept, exposes them to disease from the slightest shower, and it is not in the nature of things that life can be long supported under such circumstances. If, however, they are determined to use only the jib and pulley, and to raise the burthens by their own weight, instead of employing the whole crane, they must necessarily destroy their strength by efforts which exhaust and tear them to pieces. If, again, in the operation of pile driving, brute force were employed to work the engine, as is indeed frequently the case, the toil now sustained by human beings would be transferred to horses, and the labour of superintendance would be substituted for the labour of continually lifting an immense weight. Thus machinery may be said to have a tendency to lengthen human life; and perhaps it is not going too far, to assign the increase of machinery as one amongst the causes which have contributed to that extension of the average duration of human life, which is known to have taken place in this country since the period most remarkable for its general introduction."

The lecturer referred to two large transparencies, representing

respectively, the skeletons of a man and a horse, and gave a general explanation of the anatomical structure of each; pointing out the manner in which the muscles act upon the bones—the relative situations of the centre of gravity when the man or the horse is employed in pulling or in carrying a load;—and from the difference of structure existing between the human being and the quadruped, deducing the inference that man was not intended to be a toiling animal. "His endeavour, therefore, ought to be to diminish the efforts of the body, and increase those of the mind; and nothing can so effectually accomplish these objects as the increased employment of machinery, the effect of which will be, that his body will enjoy better health, his mind will suffer less anxiety and turmoil, and the general amelioration of his condition will follow as a natural consequence."

[*Extractor.*

Account of the performance of various Rail-road Carriages on the Liverpool and Manchester Rail-way.

(Continued from page 210.)

4. The Cycloped.—*Mr. Brandreth, of Liverpool.*

The motive power in this engine is gained in the same way as in the tread mills of prison celebrity, and the dog mills which we have sometimes heard of, only that horses, instead of men or dogs, are the agents employed. A still nearer resemblance to it may be traced in the common squirrel cage, if the reader will, but for the sake of the comparison, suppose that the squirrel drives its circular cage round by treading on the outside instead of the inside. A common wagon frame mounted on wheels is divided longitudinally into two compartments or stalls, and the bottom of each of these stalls is occupied by an endless chain of cross bars, which work into and revolve round the axles of the carriage. The horses are placed in the stalls, and by treading on the endless chains, produce the rotary motion requisite to propel themselves and the carriage forward.

The experiments made on the rail-way with this engine, did not, we believe, establish any gain, either in point of power or speed, by this new mode of applying horse power; but the apparatus was of rude construction, and can scarcely be said to have given the principle of the invention fair play. The stalls, in particular, were too narrow, and greatly cramped the action of the horses. We have no doubt that in a well constructed carriage of this description, horses might be made to work *on a rail-way* with considerably more effect than by drawing, or, at least, with equal effect and more ease. One of the principal elements of the velocity attainable on rail-ways, is the momentum which a body in motion acquires on a level or down an inclined plane; and this must often reach a point, at which any power of draught that can be applied will be not only of no use, but an actual obstruction to the velocity of the body. Suppose this

momentum should amount to a force equal to a velocity of 13 miles, *that* is a rate of velocity at which the utmost a horse can do is to move its own weight; so that were he even able to continue galloping in advance of it, he would gallop to no purpose. But suppose farther that the momentum or velocity of gravitation should exceed the speed of the horse—which as there are few horses that can travel 13 miles an hour, is a very probable case—either the horse must be run down, or the carriage compelled to stop. Now, by transferring the horse to the inside of the carriage, he will be not only removed out of the way of this momentum, but enabled to participate in the benefit of it; he will be spared all the toil of running ahead of the carriage to no purpose, and required to exert no more power than is just necessary to overcome the friction of the road, that is, to set the carriage a-going.

Any power, however, which such a carriage as "The Cycloped" might possess must always be much inferior to that obtained through the agency of steam, both in cheapness and efficiency.

5. The Perseverance—*Mr. Burstall, Edinburgh.*

The name of this engine may be considered as commemorative of the spirit with which its ingenious inventor has persevered for several years, and under many discouraging circumstances, in his endeavours to apply steam power to the propulsion of carriages on common roads. "The Perseverance" does not differ in many material respects from the original steam carriage of Mr. Burstall, which we described at length in our fourth vol. p. 433. The chief difference is, that the boiler and furnace, instead of occupying the same carriage with the rest of the machinery, are placed on a separate carriage, attached to the hinder part of the other, and the object proposed to be gained by this alteration is, that they may be more out of the way of the passengers in the event of any explosion taking place.

Among the most valuable of the subordinate improvements may be ranked a mode of steering the front wheels, by means of a spur and an endless chain, instead of a wheel and a pinion, as in the original machine, and a provision for obtaining at will an increase of power in ascending hills.

Comparative Statement of the Performances of the Engines which competed for the Premium offered by the Directors of the Liverpool and Manchester Rail-way.

In drawing up the present comparative statement, we have left altogether out of consideration the particular competition which called forth the performances here contrasted, and have looked simply to the performances themselves without reference to any conditions or stipulations whatever. It by no means follows, that because the judges in this competition thought fit to require that each engine should run a distance of seventy miles, it is only from the performance of such a distance continuously we can form a right judgment of the capabilities of an engine, or that, because "The Rocket" was

the only engine which accomplished that distance, it is superior to every other. All that is requisite, is, that the distance should be such as to exclude the possibility of our mistaking a momentary for a permanent display of power; and a distance of twenty or thirty miles is as good for this purpose as one of sixty or seventy. The case will, perhaps, be set in a clearer light, if we substitute *time* for *distance*. No one would think of calling an hour's running at a time a mere momentary display; nor can any reason be imagined why an engine that can go fifteen, twenty, or thirty miles in one hour, should not go at the same rate for any number of hours. A steam engine is not like a horse, which becomes gradually exhausted by exertion; it is as strong and fresh at the end as at the beginning of any journey, however long that journey may be. It has its source of power in the steam generated by the boiler, and the same quantity of steam which a boiler generates at one time it must be capable of generating at any other time (the supply of water and fuel remaining always the same.) The durability of the materials of which the boiler consists, may be affected by the continuity of the process; but that is an evil which would scarcely, in any case, be felt till after the lapse of a considerable period. It is not, at least, such a drawback as would be taken into account in any experimental trial of the description contemplated by the late competition. Now, though "The Novelty," "The Rocket," and "The Sans Pareil" did not all run 70 miles each, as required by the "ordeal" of Messrs. Rastrick and Wood, they all ran uninterruptedly for more than an hour at once, and to contrast what they did in this equal and adequate space of time, is manifestly a much surer and fairer method of determining their comparative services, than to rank them according to the total distances they ran in different times.

Neither "The Cycloped" and "Perseverance" did perform for an hour continuously, and they are not, therefore, included in our comparison.

I. The first point to which we have to attend, is the respective weight of the engines, since according to their weight must be the degree of friction which they have to overcome. For the reasons we have assigned in a previous number, there must be included in this weight the whole working power of each engine, that is, the whole of the machinery and the whole of the materials necessary for putting and keeping it in motion; and, for the sake of greater clearness, we shall reduce this weight into pounds. Each engine is supposed to be fully equipped for a journey of 35 miles continuance.

	Tons.	Cwts.	Lbs.	
"The Novelty" weighed, according to the canal carrier's receipt, - - - - - -	2	15	0	
Add for water in the boiler, - - - -	0	4	2	
Water in the tank, - - - - - -	0	11	12	
Coke baskets and coke - - - - -	0	0	76	
The three last items estimated by Mr. Vignoles.				
	3	10	90 =	lbs. 7,930

	Tons.	Cwts.	Lbs.	
"The Rocket," according to the official list of the carriages entered for the competition, weighed	4	3	0	
The additional tender with its contents, was stated to weigh - - - - - - -	1	13	0	
	5	16	0	= 12,992 lbs.
"The Sans Pareil" weighed, according to the same official list, - - - - - -	4	8	0	
Add for tender and its contents, - -	1	13	0	
	6	1	0	= 13,652

From this comparison it appears, that the working power of "The Novelty" weighs little more than one-half that of either of the other engines. It must of course have to that extent less friction to overcome, and do less injury to the rails. It may be supposed that as it weighs less, it will exert proportionably less power: but this is not the case; the area of the cylinder being nearly, and the pressure on each piston precisely the same, in all the three engines.

II. We have next to consider the *quantity of fuel* consumed by each engine.

The owners of "The Novelty" professed to be able to go one trip of 35 miles with 4 bushels of coke; and what they did perform leaves no doubt on our minds that this is a fair estimate of the quantity that would be required for such a distance.

The fuel consumed by "The Rocket" in performing its two trips of 35 miles each, was stated to be about half a ton.

Of the quantity which "The Sans Pareil" consumed in going its 25 miles, we have no exact account, but we have been informed that it was nearly as much as "The Rocket" required for performing double the distance. The different construction of the boilers of the two engines furnishes a sufficient reason for believing that "The Sans Pareil" must consume a great deal more fuel than "The Rocket;" and we shall not probably err much if we assume that the difference amounts to one-fourth more.

The quantity and cost of the fuel expended by each engine per mile, will, according to these data, stand as follows:—

	PER MILE. Quantity. lb.	oz.	dr.	Cost about.
The Sans Pareil (12 cwt. 2 qrs. ÷ 75)	18	10	10	2 pence.
The Rocket (10 cwt. ÷ 75)	14	14	14	3 halfpence.
The Novelty (4 bushels, or 168 lbs ÷ 35)	4	12	12	1 farthing.

The saving of expense is not the only advantage gained by reducing the expenditure of fuel; there may be situations, indeed, where fuel is so cheap as to make any saving in this respect of no moment. A matter of far greater importance is the increased facility which is thus given to the employment of steam power for the accomplishment of long distances—at sea particularly. An engine which, like "The Novelty," is worked with two-thirds less fuel than any other engine, will of course go three times the distance

with the same quantity, and have only to stop once to take in a new supply, while the others have to stop three times.

A reduction so great as has been realized in the case of "The Novelty" was never before accomplished, nor ever, we believe, supposed to be within the limits of attainment. Mr. Gurney was thought to have done wonders, when it was announced that he only consumed half a bushel of coke per mile, at an expense of twopence; but here we have a mile performed with less than the fourth of half a bushel, at an expense of only one farthing!

III. We now proceed to compare the *rate of speed* accomplished by the different engines.

"The Novelty" went on the second day of the competition, with three times its weight attached to it, 20¾ miles in one hour. The total weight moved, including the carriage, was about 15 tons. In calculating the weight in this instance, no deduction was made on account of the engine's carrying its own water and fuel, but when prepared for its intended trials on the subsequent days of the competition, due allowance was made for this circumstance. The load then assigned to it by the judges was 6 tons 2 cwt.* When it accomplished the trips recorded by Mr. Vignoles, the total weight moved, including that of a number of persons on the engine and wagons, was only 10 tons 6 cwt. 1 qr.; and the speed which it then realized was nearly equal to 22 miles an hour. It will be observed, that though some increase of velocity was thus acquired, it was by no means proportional to the reduction of the weight; a circumstance which is doubtless to be ascribed to the very imperfect working order in which the engine was at the time of this second trial. When the weight drawn was reduced to merely that of a wagon containing 45 persons—equal to about 3½ tons—and the total weight moved to about 9 tons, the velocity was increased to 30 and 32 miles per hour; a rate which, though unprecedentedly great, is still less than what the previous performances of this engine, with double that weight, might have warranted us to expect from it.

The total weight moved by "The Rocket" when it went the 70 miles continuously, was 17 tons; and the greatest number of miles which it traversed in any one hour, was 12½. Stripped of all weight, and carrying just as much *matériel* as would suffice for a couple of trips of a mile and a half each, it went at the rate of 30 miles an hour. Drawing a carriage loaded with passengers, it went at a velocity which sometimes reached 24 miles an hour.

The weight drawn by "The Sans Pareil," if calculated in the same way as that assigned to "The Rocket," must have been 13 tons 6 cwt. (and not 18 tons, as stated in our account of the sixth day's proceedings)—the total weight moved 17 tons 14 cwt. The greatest speed which it accomplished in one hour was 12½ miles.

The superiority of "The Novelty" is least apparent in the instance of its drawing the least weight; but that as we have before

* In our account of the seventh day's competition we stated, that the weight assigned was 5 tons 16 cwt.; the difference arises from our omitting to include the weight of the water in the boiler.

said, must have been owing to its being in a less efficient state on that occasion. Since "The Rocket" doubled its rate of speed when it had only a carriage and passengers to draw, we can see no reason why "The Novelty" should not have done the same had its machinery continued in an unimpaired state.

Award of the Premium.

Extract of a Letter from a Correspondent.

"Liverpool, 26th October, 1829.

"The prize has been at length awarded, and as you rightly conjectured in your last, to Mr. Stephenson. The directors had no alternative, since "The Rocket" was the only engine which fulfilled the conditions of the competition. There are people here, however, who think that the interests of the public would have been quite as well served, had the directors adjudged the premium on a more general view of the matter, and conferred it on that engine which is, upon the whole, "the most improved." I have seen at the Rail-way Office, the report of the judges, but cannot say that I have been at all gratified by the perusal. It is confined to a simple report of the performances of the different engines, drawn up with but little discrimination, and in some instances (as I imagine) rather ignorantly. It might have been expected of two gentlemen, who were called in to aid a body of directors with their scientific knowledge on the occasion, that they would have made it their business to point out the improvements which the competition has been the means of producing in locomotive machinery, by whom they have been effected, and to what results they lead. But there is nothing of the kind. The directors are left to cull conclusions for themselves out of the facts presented to them; and for aught that appears in the face of the report, it might be inferred that all the *novelty* is on the side of the *Rocket*, and that the *Rocket* is the only real *Sans Pareil*. I need not, however, enlarge on the merits of this document; it will, of course, be soon given to the public, and speak for itself. The directors have offered to purchase both the unsuccessful engines—unsuccessful, at least, as regards the prize; but the offer does not seem to have been viewed in the same light by their respective owners. Ackworth, who had embarked all his means in the building of "The Sans Pareil" has gladly accepted the offer; Messrs. Braithwaite and Ericsson have declined it, under an impression that it might seem their engine was bought less for its merit than on account of its misfortunes. They say they want nothing in the way of favour; and that if they can prove, as they trust to do, that their engine is better adapted to rail-way purposes than any other which has yet appeared, it will not be an order for one, or a dozen, or yet fifty engines, that will satisfy the wants of our rail-way. "The Novelty" is still here, undergoing a general repair, and is expected to exhibit again on the rail-way in the course of next week, when it will be brought to a final test, whether it can maintain, for any length of time, the extra-

ordinary speed which its partial performances during the competition displayed."

[From the Liverpool Times of October 27.]

"*The Rail-way Contest.*—On Tuesday last, the judges appointed to report on the performances of the locomotive carriages at Rainhill, gave in their report to the directors, and in consequence of the opinion expressed by them, the prize of £500 was adjudged by the directors to Mr. Robert Stephenson, of Newcastle. It has not yet been decided whether the report of the judges shall be published or not: we understand, however, that it expresses no opinion as to the principle of Messrs. Braithwaite and Ericsson's carriage, but merely gives a statement of the respective performances of the different carriages. Messrs. Braithwaite and Ericsson, the proprietors of "The Novelty," and Mr. Robert Stephenson, the proprietor of "The Rocket," are both engaged in improving and perfecting their carriages. The former is now repairing at Messrs. Fawcett's yard; and it is said that it will be tried again on the rail-way when finished. A considerable alteration has also been made in Mr. Robert Stephenson's engine, which has greatly increased its powers. It was tried again on Saturday, when it drew the enormous weight of 20 tons, at the rate of from 18 to 20 miles per hour."

FARTHER EXPERIMENTS WITH "THE NOVELTY" STEAM CARRIAGE.

Extract from a Letter from a Correspondent, dated Liverpool, December 17, 1829.

"The anxiety universally entertained by the people here to see their favourite, 'The Novelty,' again at work, has been at length partially gratified.—Having undergone a thorough repair at Messrs. Fawcett and Co.'s factory, and been privately proved there in various ways, she made her re-appearance this morning on the rail-way under the charge of Mr. Ericsson, and has been going *the whole day* with the greatest success: no accident or interruption of any kind (as far as regards the engine) occurred. She travelled sometimes with, sometimes without passengers, and at various speeds, generally from 25 to 32 miles per hour. In several turns her rate of going averaged full 40 miles per hour! The bearings most liable to be effected by this rapid speed, namely, the crank-couplings, the eccentrics, and the axle-tree brasses, *were not once oiled*, from the time the carriage began working till the conclusion of the day's operations. Nothing can be conceived more beautifully smooth than the entire action of this carriage; all its parts worked in admirable harmony with each other. The steam appeared to be got up and kept up at the requisite pressure, with the greatest ease, and at a wonderfully small expense of fuel. The spectators, who were at one time very numerous, were much delighted, and repeatedly testified their admiration by loud cheers. But that the rail-way shares have already reached so high a premium, (about 80 per cent.!) as scarcely to admit of any further advance, I should not be surprised to see

them take another start to-morrow. '*The Rocket*' has been also doing wonders in the way of speed; but the superior compactness, steadiness, and elegance of 'The Novelty,' combined with even the same speed as 'The Rocket,' would be sure to procure for it a decided preference. In order to prove *the power* as well *as speed* of the engine, a number of loaded wagons were attached to it; but by this time it was becoming dark, and the distance performed was not sufficient to furnish any satisfactory result. The experiments will be probably resumed to-morrow, or in a day or two after, when I shall again write you all about them."

Extract from another Letter from the same Correspondent, dated Liverpool, December 21.

"I am just returned from Rainhill, and have but time, before the departure of the post, to acquaint you briefly with the results of another long day's experiments with '*The Novelty.*' It drew for several hours a gross weight of *thirty-five tons*, that is at least ten times its own weight, at the rate of *twelve miles per hour!!!* Can it now be doubted that this is as efficient an engine for weight as for speed? The superiority of the blast principle may be now considered as established beyond all doubt." [*Mechanics' Magazine.*

On the advantage of Large Wheels in Rail-way Carriages, and the means of ascending Inclined Planes.

Sir,—The advantages derivable from the use of wheels of large diameter, seem to have been strangely neglected in all carriages used upon rail-ways, the wheels of the engines being generally less than 4 feet, and of the loaded carriages less than 3 feet diameter. To convey some notion of the amount of these advantages, I shall give the result of two experiments made by Mr. Wood, the details of which are given in his Treatise on Rail-roads.

A locomotive engine mounted on wheels of 3 feet diameter, drew after it 9 loaded wagons weighing 731 cwt. 36 miles in 9 hours and 33 minutes: the wheels were then removed and replaced by others of 4 feet diameter; and with this single alteration the engine drew the same load 48.8 miles in 9 hours and 27 minutes, the consumption of fuel being the same in both cases, viz. 2534lbs.: hence, as Mr. Wood observes, if the load and the consumption of fuel be the same, the space passed over in a given time will be as the diameter of the wheels, for 3 is to 4 as 36 to 48, and also *by enlarging the diameter of the wheels of the engine the velocity is increased, and the consumption of fuel diminished at the same time:* for if we suppose 36 bushels to have been consumed in each experiment, the expense per mile will be one bushel in the first experiment, and only three-quarters of a bushel in the second; whilst the velocity in the first experiment was 3.7 miles per hour, but in the second 5.15 miles per hour.

Although from the great scale on which the experiment was made,

and the time it occupied, it is decisive upon the subject: the result has certainly an air of paradox, for there appears to have been a gain of power and velocity at the same time; and as the wheels may be supposed of any diameter, it may seem to prove that the mechanical effect of a given power may be indefinitely increased, and consequently exceed the power expended; but if we examine what is the real mechanical effect in moving a carriage along a horizontal plane, the air of paradox will disappear, and it will be seen that the result of the experiment is in accordance with the laws of motion.

The resistance to the motion of wheel carriages (independent of that caused by the air) may be divided into two parts, that at the rim and that at the axles; the resistance at the rim is occasioned by the inequalities of the surface on which the carriage travels, the whole weight of the carriage requiring to be lifted through the perpendicular height of each obstacle, and of course requiring a force to be exerted equal to its own weight, moving through the same space. But in a well laid horizontal rail-way of good construction, the resistance at the rim of a perfectly circular wheel is so very small, that we may, in practice, consider the resistance at the axles as the only obstacle to the motion of the carriage.

The resistance at the axles is the friction of the wheels during their revolution on the axle, and the amount of this friction in any given time will depend upon the weight with which the carriage presses the axles; and the space through which this pressure acts, and the amount of friction overcome in any given time will be the real measure of mechanical effect in that time; therefore if the weight of the carriage be always the same, and the wheels perform the same number of revolutions in any given time, the friction or mechanical effect will always be the same, and will only require the same expense of power; but the space through which the wheels roll at each revolution on their axles will be as their diameter, and if the revolutions be made in equal times in all cases, the horizontal velocity of the carriage must also be as the diameter. Thus it will be seen that the real measure of effect in transporting carriages along a horizontal plane, is as the pressure at the axles multiplied by the number of revolutions, and not as the weight of the carriage multiplied by the space through which it passes, as would be the case if the carriage moved in a vertical instead of a horizontal path. If the plane be inclined, then in addition to the friction of the axles there is the gravitating power of the load to be considered, which will be as the weight of the carriage and the perpendicular height of the plane; and as it is only the friction at the axles which is reduced by increasing the diameter of the wheels, the increase of velocity will not be as the increase of diameter, but as the increase of diameter divided by the proportion which the friction bears to the gravitating power of the load. Thus, if it require a force of 16 cwt. to overcome the friction of a carriage on a horizontal plane, the carriage weighing 10 tons, it will require to move the same carriage up an inclined plane, 100 feet long, with a rise of 2 feet, an additional force of 10 tons moving through 2 feet, or 2 cwt. through 100 feet; and the

whole force required will be 3 cwt. through 100 feet. Moreover, as the friction is only $\frac{1}{3}$ of the whole resistance, the increased velocity obtained from increasing the diameter of the wheels is only $\frac{1}{3}$ of what it would be on a horizontal plane.

Another advantage which large wheels possess over small ones is, that they are less liable to slip or turn round on the rails without advancing the carriage; and this advantage Mr. Wood has wholly overlooked, for in his experiments to ascertain the amount of adhesion of the wheels to the rails, he states it to be $\frac{1}{2\frac{1}{5}}$ of the weight of the engine, without adverting to the size of the wheels. Now the adhesion evidently depends upon the weight of the carriage and the diameter of the wheels jointly, for the force with which the circumference of the wheel is pressed by the carriage against the rail, may be considered as a weight acting at the end of a lever, whose length is the radius of the wheel, and the resistance will be as the radius is to the length of the crank by which the wheel is turned: or, as the amount of friction is as the pressure and as the space through which it acts, the friction of the wheel in slipping during any portion of a revolution will be as the diameter of the wheel; therefore the *weight* of the engine may be diminished or the weight of the load to be drawn may be augmented, if the diameter of the wheels be increased, provided the *power* of the engine bear always the same proportion to the load.

The superiority of large wheels over small ones being so evident, I have no doubt that in future attempts at improvements on locomotive engines, greater attention will be paid to this point, and that the diameters will be increased as far as is consistent with strength, and without adding too much to the weight; and the limits in this case will, I think, be best attained by wheels on Mr. T. Jones's construction, which may now be had formed entirely of wrought iron, and which far exceed in lightness and strength any wheels hitherto employed on rail-ways. What these limits may be is hard to say, but it seems not too much to expect that wheels of 8 or 9 feet diameter may be employed; for the wheels of timber wagons and also of the French diligences are frequently 6 feet in diameter, although made of wood, and exposed to great transverse strains from the inequalities of the road. Eight feet, therefore, does not seem to me too great a diameter for iron wheels upon a rail-way, and exposed to no transverse strain; and the stability might be rendered even greater than at present, as the diameter would admit of the boiler and the rest of the apparatus being placed below instead of above the axles.

There is another point to which I would advert, viz. the means of ascending a plane, the acclivity of which is too great to be overcome by the adhesion of the wheels: in this case the carriages are in general hauled up by a rope wound round a barrel turned by a fixed steam engine; but the friction of the rope along the plane, although supported by friction rollers, amounts in many cases to nearly one-third of the whole resistance, whilst in most cases the ascent might be surmounted by either of the following methods:—1st. By means

of a toothed rail along the whole length of the inclined plane, into which a toothed wheel attached to the locomotive engine works, as on the Middleton Colliery Rail-way at Leeds. Or, 2nd, by means of a chain extending the whole length of the plane, and made fast at each extremity, and a spike wheel attached to the locomotive working into the links of the chains: for this method Mr. Chapman has a patent, if it be not expired. By either of these methods the friction before mentioned would be avoided, and fixed engines be unnecessary, which would be a great advantage, especially if rail-ways should ever be laid by the side of turnpike roads.

If you can spare a space in the "Mechanics' Magazine" for the insertion of these suggestions,

You will much oblige your most obedient servant,

J. Murdoch.

[*Ib.*

On preventing the Warping of small Files in Hardening.

Sir,—Your correspondent "C. C." wishes to be made acquainted with "the method which file makers adopt to prevent the warping of their small files in hardening." To satisfy his inquiries, I send you a few hints; and should "C. C." find them useful, and make the result of his experiment known through the medium of your valuable work, he will by so doing "confer an obligation" on me; as I am of the opinion, and perfectly agree with your correspondent, Mr. Mackinnon, who justly observes, that to be master of the above art "requires experience, and cannot be taught by written directions."

First, forge your steel plates to the size required, after which they must be softened, thus:—take a quantity of wood chips, and having heated your plates hot enough to set them on fire, let them be placed thereon, and remain there until the whole of the chips are consumed, and the plates cool. Your plates must now be filed perfectly level for cutting; and the same method must be resorted to in files which require to be re-cut. When they are cut, they should be placed in a mixture of lime and water, of moderate thickness, in which they may remain for any length of time, or till you wish to harden them; they will not rust, or take any hurt, by lying in this solution, the lime being a preventive.

When you feel inclined to harden them, they must be taken out of the mixture, and placed directly before a good fire, to dry the lime, which will fill up the cavity between the teeth, and is only used to prevent the fire from destroying the same during the process of hardening. You must now have in readiness a tub, containing three pailsful of spring water, into which you may place the following ingredients:—

8 oz. of sal-ammoniac, powdered;

8 oz. of aqua-fortis;

1 lb. of common salt;

which water may be kept for hardening some time. You must also have at hand a wooden mallet and block, in case of your file coming in contact with a piece of coke, &c. while getting your heat, and causing the same to bend; in which case you must lay your file upon the block, and gently press the crooked part with the mallet until you have made it perfectly straight. It is farther necessary to have a flat box, containing 1 lb. of common salt, in which you must rub your file every time you take it out of the fire to ascertain your heat. Having all these requisites prepared, then blow up a good loose fire, free from gas or green coal; and when you have got a good red heat, hold your file as perpendicularly as you possibly can over the water, and sink it gradually, in the like position, into the same as far as the tang, or handle, which must not be hardened.

By this process you are likely to harden many files at the first attempt; yet sometimes you cannot prevent some from warping. If any of them should do so, they can be remedied thus:—put a quantity of grease or oil into a long flat pan, into which place the files which are warped; then heat a piece of iron red hot, which place in a vice, and take one of the warped files out of the oil pan, and fasten a hand vice at each end to hold it by; then humour the same backwards and forwards, according to the warping, which will presently come straight, taking care to keep plenty of oil upon your file, which preserves the temper of the steel, and prevents the heat of the iron from softening it. This done, nothing remains to be observed but cleaning.

Place your files into a pail of warm water; then take a hard brush, on which place a little soap, and brush them till all the lime which still remains between the teeth is completely washed out; then place them directly before a good fire to dry, and brush them again with a dry brush. Finally, take a small quantity of the best oil, and drop a little on a soft brush, and rub them all over with the same, taking care to let the files be a little warm, which will cause the oil to spread more thinly over them. They are now in a fit state to be laid by till wanted for use.

This, sir, is all the information I can give your correspondent respecting this matter. But, before I conclude, I should advise him to forge out a few pieces of steel to the dimensions required, and let him practise hardening the same, till he is somewhat perfect; by which means he will save a quantity of files which he might otherwise spoil.

R. Daniel.

[*Ib.*

On the Precautions which ought to be taken in the Preparation and Use of the various inventions for producing Instantaneous Light.

[From De Moleon's *Recueil Industriel*, with additions by Thos. Gill, Esq.]

"The first apparatus of this kind, were the *phosphorus bottles;* and, for a long time, they were only prepared by the makers of phi-

losophical instruments. They were made by introducing a certain quantity of phosphorus into small bottles, which were then placed upon a sand bath, and when the phosphorus was melted, they repeatedly plunged into them a red hot iron; by this means a portion of the phosphorus became oxided, and the mixture which resulted from the operation, possessed the property of inflaming, when brought into contact with the air. To light a sulphured match, it was sufficient to open or unstop the bottle, to plunge the match into it, and to rub off or detach a small portion of the phosphorus; and, upon withdrawing it from the bottle, the match was kindled. This contrivance, however, had the inconvenience of the phosphorus powerfully attracting the humidity contained in the air; so that in the space of a short time, and unless the bottle was instantly carefully closed by a well fitted ground stopper, it lost its effect."

The Editor prepared these phosphoric bottles many years since, and found that a white saline efflorescence had formed itself, and covered the surface of the phosphorus; and, upon taking a little of it up, on the point of a match, and bringing it into contact with moisture, it instantly took fire, with a sudden flash of light.

"To these phosphorus bottles, the preparations known under the name of *Inflammable Mastic* succeeded, the first of which was invented by the baron Cagnaird Delatour. This preparation was free from the inconvenience of attracting the humidity of the air, and would last until the matter inclosed in the bottles was completely exhausted. This matter was phosphorus, in a particular state of combination, and which could not be imitated by any other manufacturers. But the price of it was too high, and others, therefore, endeavoured to make compositions possessed of similar properties, but at lower prices. In order to this, they mixed phosphorus with magnesia, and other earthy matters, but they did not possess the good qualities of the above mentioned ones; as they would only act for a short time, and became quickly spoiled."

The Editor recollects a composition of this kind being made by a chemical friend of his in London, and which was possessed of the above valuable property. The specimen he saw was inclosed in a bottle, and had a brown colour, and also smelled strongly of camphor; on a little of it being taken up on the point of a match, and brought in contact with the air, it quickly caught fire. The preparation of it was, however, kept secret.

"The *phosphoric bougies* were invented about this period. They consisted of slender glass tubes hermetically closed, of about the eighth of an inch in diameter, and four inches long; and they contained a cotton wick, dipped in white wax, and secured into one end of the tube; the other end of the cotton wick being placed in contact with a small portion of phosphorus, which, no doubt, had been oxided by the method indicated at the beginning of this article; and, upon breaking the tube across, at a place marked by a small band of paper, cemented around the tube, at the end opposite to that containing the phosphorus, and drawing out the cotton wick, the phosphorus upon it instantly caught fire. These continued in use for a considerable period, but they had also the misfortune of being too dear.

"To these succeeded leaden bottles, each containing a piece of solid phosphorus, and closed with corks. Upon taking up a little of this phosphorus on the point of a sulphuretted match, and rubbing it backwards and forwards a few times upon a piece of cork or felt, the sulphur on the match combined with a little of the phosphorus, and kindled from the heat occasioned by the friction."

These leaden phosphorus bottles are now commonly sold about the streets of London. They have the inconvenience, however, of the mass of phosphorus being exceedingly liable to take fire, and thus to do mischief; and they also then become useless, until the phosphorus is replaced.

The Editor well recollects his friend Mr. J. T. Cooper, Lecturer on Chemistry applied to the Arts, several years since preparing matches tipped with sulphur and phosphorus; and which quickly ignited, when rubbed upon a piece of cork. Possibly the common sulphured matches may be rendered capable of quickly igniting in this manner, by merely rubbing their points upon a stick of phosphorus, placed in a shallow vessel of water, to prevent it from taking fire from the friction. The matches ought to be prepared, however, shortly previous to using them, and before the phosphorus is become decomposed; and they should likewise be kept in boxes, or close stopped bottles, and be thus secured from any danger of igniting by accidental friction.

The Volta's Lamp, in which the jet of hydrogen gas is kindled by an electric spark, may be justly added to these instantaneous methods of procuring fire and light; and so also may be the fire cane, and the still more portable instruments of a similar kind, as the fire tubes, &c. for igniting German tinder, by means of strongly and rapidly compressed air.

"The modern chemists having discovered that the chlorate of potash causes combustible bodies to burn more rapidly than nitre, thought of applying it to the preparation of gun powder, and the first experiment which was made at Essone, cost the lives of the workmen; because they were ignorant that it would inflame, unless by the sparks produced by the contact of flint and steel, or by bringing it into contact with a burning body. Whereas, simple percussion, or the friction produced between two hard substances, was sufficient to inflame it with detonation! In consequence, the preparation of these mixtures was exclusively confined to the laboratories of the chemists, and designated in their writings, by the name of fulminating powders.

"But as it was also known, that this combination had, amongst other qualities, the property of inflaming, by simple contact with the concentrated sulphuric acid; so they were not long in bringing this property into use, and which offered great advantages in kindling, what are now termed, the *oxygenated matches*.

"It is convenient to divide the manufacture of these oxygenated matches into two parts. The first, consists in inpalpably pulverizing the chlorate of potash, and intimately mixing the powder with flour of sulphur. But, as we have before mentioned, a similar mix-

ture violently detonates by percussion, or merely by the simple friction between two hard bodies, such as the pestle and mortar, or the muller and grinding stone. The accident at Essone was not the only one of the kind. Mr. Rochette, jun. an optician, residing at Paris, and who was one of the first persons who manufactured the oxygenated matches for sale, lost his life from a detonation, occasioned by preparing this mixture for use; and a loss was besides sustained, amounting to more than 1200 francs.

"Another druggist of Paris, also lost a young man, owing to a similar accident; and we could mention many others. And, indeed, in two particular instances, the quantities of the mixture operated upon, amounted only to a few ounces in weight. But now-a-days, and in consequence of the great consumption made of these oxygenated matches, we cannot too much recommend the proper authorities to superintend the manufacturers, who prepare many pounds of this mixture daily, and to oblige them to remove their workshops to a distance from any habitation; and also to make a law, to prevent them from mixing the composition with gum arabic. It is in vain, they say, that the detonating mixture is modified, and that they have diminished the proportion of chlorate of potash, by substituting nitre in place of it. As it is a fact, that this new mixture is not less detonating than the former one!

"The second part of the manufacture of these oxygenated matches, consists in making a thick fulminating mixture of the chlorate of potash, sulphur, and nitre, by tempering them with a sufficient quantity of a weak solution of gum arabic in water. Sometimes the manufacturers add a little vermillion to the mixture, to colour it red; but they frequently leave it of its natural colour, which is a pale yellow. It is sufficient to plunge the extremity of the match into one of these thick mixtures, to the depth of about the eighth of an inch, and to leave it to become dry. The matches are similar to the common ones, except that they are only sulphured at one end, and are made of double the thickness.

"This second part of the manufacture presents no danger, and may, therefore, be permitted, without inconvenience, to be carried on in Paris. It is even advantageous, as it employs young children, and removes them out of the way of contracting those vicious habits, which idleness generally brings upon the poorer classes of people.

"To make use of these oxygenated matches, it is sufficient to plunge the prepared end of one of them into a small bottle containing asbestos, imbibed with concentrated sulphuric acid, and instantly to withdraw it. The sulphuric acid acts upon the deflagrating matter, and inflames it, as well as the sulphur, and thus kindles the match. These matches have no other inconvenience than that of burning small holes in the clothes of those persons who are in the habit of using them.

"The detonating or fulminating matches, are those, which after being lighted by any means, at a certain period of their burning, make an explosion. These matches are more costly than the others; and, consequently, are only purchased by persons who know what

they require. At present, they are only sold by the dealers in objects of philosophical amusement. The preparation of these matches is simple: it consists in making, by means of a small gouge, an excavation in the stem of the match, at about a third part of its length, from the prepared end of it; and raising up the loosened part of the wood, introducing into the hole, made at the farther end, an atom, either of fulminating silver, or fulminating mercury, but especially the former; and then glueing up fast the small slice of wood raised by the gouge.

"These detonating matches present no danger, but only to the persons preparing them, and even that danger is not great; as with a *gros* weight only of the fulminating material, they may prepare many hundred matches; and the consumption of these being limited, the manufacturers consequently never keep any considerable quantity of the fulminating matters by them. We, therefore, think, that the manufacture of these detonating matches may, without inconvenience, be permitted in the city. It is always easy to distinguish these detonating matches from others. It is sufficient to examine them; and we may always perceive a part upon their stems which shines, and indicates the place into which the fulminating material has been introduced, and finally glued over. Nevertheless, we should wish that persons would cease to make use of this kind of sport, which, in many circumstances, is not without danger; owing to the fright which they occasion, and to females in particular, when they are thus taken by surprise."

We find an instantaneous light, lately described in *The Quarterly Journal;* and which is evidently formed by the application of detonating silver, or fulminating mercury, to the surface of the wood at the end of a match. It is thus described: "Instantaneous Light.—Amongst the different methods invented in latter times, for obtaining a light instantly, ought certainly to be recorded that of a chemist, at Stockton upon Tees. He supplies the purchaser with prepared matches, which are put up in tin boxes, but are not liable to change in the atmosphere; and also with a piece of fine glass paper, folded in two. Even a strong blow will not inflame these matches, because of the softness of the wood underneath; nor does rubbing upon wood or any common substance, produce any effect, except that of spoiling the match. But when one is pinched between the folds of the glass paper, and suddenly drawn out, it is instantly inflamed." Now we well know that detonating silver will readily explode by the friction of glass paper, and is accordingly employed in many various ways, as in the laces, tapes, or girths of security, against house breakers, &c. &c.; and therefore these new instantaneous lights are no doubt formed, by its application to the points of these soft wood matches, and most probably in mixture with camphor, resin, sulphur, or other inflammable materials. Care ought, however, to be taken in their use, lest, by falling upon a sanded floor, and being accidentally trod upon, they may take fire, and thus do great mischief!

We well recollect serious accidents having been occasioned, by

the chemists who first prepared the fulminating silver here, not being fully aware of its nature; and, in particular, Mr. J. T. Cooper, losing his eye sight for a considerable time, owing to a portion of it, even whilst still wet, exploding, in a Wedgewood's evaporating basin, merely by his touching it with a steel spatula; it also fractured many glass vessels, and several panes of the windows; and even drove pieces of the basin into the wooden table, upon which he was at work: too much care cannot, therefore, be taken in employing this dangerous substance.

We have lately had another instantaneous light apparatus introduced under the name of the Prometheans. These are small glass bulbs, or tubes, filled with concentrated sulphuric acid, hermetically sealed, and surrounded with a mixture of inflammable materials, amongst which the chlorate of potash forms one; and the whole being again inclosed or surrounded with paper, also rendered still more inflammable by means of resinous matters. Upon pinching the end containing the glass bulb, or tube, it breaks, and the sulphuric acid instantly kindles the surrounding materials. These Prometheans are, however, expensive; and require that care be taken that the sulphuric acid, &c. do not come into contact with furniture, clothes, &c. The chief merit of this contrivance lies in securing the sulphuric acid from all danger of imbibing the moisture of the air, which is the great cause of the speedy failure of the acid bottles employed in kindling the oxygenated matches. These Prometheans are patented by the manufacturer of them.*

We have now also to add to these numerous means of procuring instantaneous light, Dobereiner's discovery of the igniting action of a jet of hydrogen gas, when thrown upon a mass of the spongy platina, and which is now employed in a variety of ways, perhaps in none more successfully, than in the apparatus invented by Mr. Jackson, surgeon, and which obtained the approbation and reward of the Society of Arts, &c. &c.

The kindling of *amadou*, or German tinder, by the sparks produced from the collision of a flint and steel, now so very commonly used here in lighting segars, ought also to be included amongst the methods for producing instantaneous light. The Editor, many years since, improved upon this apparatus, by substituting for the German tinder, a loosely twisted cotton cord, steeped in a solution of pure nitrate of potash, and which readily kindled by the sparks produced from the flint and steel. He did not, however, content himself with merely igniting the cord, and which required the use of a sulphured match to obtain a light from it; but he also prepared the cord, by coating portions of it at regular intervals, alternately with sulphur, and with wax; the sulphur readily kindled of course, by the ignited match cord, and as readily lighted the wax; and thus a flame was produced, by one operation only. This flame endured sufficiently long to seal a letter, and for many other purposes; and might even

* They are the invention of Mr. Isaiah Jennings, of New York. [Editor.

be prolonged, by thus preparing the wicks of wax bougies or candles of a greater length and thickness, with nitre and sulphur.

[*Technological Repository.*

On the Uses of Steatite; and particularly in the Lubrication of Machinery to reduce Friction.

[From De Moleon's *Recuiel Industriel.*]

STEATITE is a kind of saponaceous stone, which is sometimes found of a white colour, at others gray or green, and but rarely red or yellow. Its specific gravity varies from 2.60 to 2.66.

This substance is composed of a mixture of silex, alumine, magnesia, oxide of iron, and water; but it differs according to the localities in which it is found. It is very common in Germany, and in Cornwall; and we have no doubt that it may also be found in the western parts of France.

As steatite is not fusible excepting at a very high temperature, and as it can be worked with the greatest facility, so it forms excellent crucibles, which harden in the fire, and which litharge penetrates with great difficulty. It also serves as a facing to protect moulds for casting iron, and other metals.

M. Viscot, of Liege, made a great number of experiments to prove that this substance might be employed by the lapidaries. He formed cameos with it, to which he gave a fine polish, after exposing it to the action of the fire; and it becomes so hard, as to give sparks like flint, when struck upon hardened steel.

By polishing it, he gave the appearance of agate, and even obtained some pieces, which perfectly resembled the onyx; but this appearance was quickly destroyed by the fire, and he found it impossible to restore it.

Having a great affinity with glass, the steatite, when reduced to a very fine powder, and mixed with the colours, becomes exceedingly convenient in painting upon it. It is also used as a kind of sympathetic crayon, for drawing or writing with upon glass, and on which it leaves no apparent trace, after the drawing or writing has been wiped over with a woollen cloth. However, the marks are rendered instantly visible, by breathing upon them; but they disappear anew, when the glass becomes dry.

The embroiderers and tailors prefer steatite to chalk, to make traces with; as they are more durable, and do not affect the colours of their cloth.

As steatite has the property of combining with oil or grease, so it enters into the composition of the greater part of the balls, which are used for cleaning silks and woollen cloths from oil or grease spots. It also serves as a basis, in the preparation of certain colours for painting with.

It is employed to give a fine polish to marble, serpentine, and other gypseous stones. Mixed with oil, it is used to polish glass and metallic mirrors.

If the surface of newly prepared leather be sprinkled over with it; and if, when it has become dry, it be rubbed with a piece of horn, it will give the leather a fine gloss.

Steatite is also employed to glaze paper, upon the surface of which it is sprinkled, when it is reduced to a very fine powder; or, which is much better, when mixed with the colouring materials. To glaze the paper, it must be rubbed over with a hard brush.

The powder of steatite, owing to its unctuosity, is one of the substances employed in lessening the friction of screws, toothed wheels, and other metallic contacts.

Steatite is a mineral, which belongs to the primary or secondary formations. It often constitutes beds of great extent, but when pure, it usually forms lumps of greater or less magnitude. That variety of it, termed Venice talc, abounds in the Tyrol and the Valteline. The Briancon and the Spanish chalks are found, the one in the Alps of Dauphiny, near Briancon; and the other in the mountains of Arragon. The Venice talc affords a powder, which renders the skin smooth and shining, and is employed as a cosmetic. The lard stone is also another kind of graphic talc, and is used in China, to form small grotesque figures.

Fat, and fixed oils, have long been used to lessen friction in machinery. But the bad properties, and the ill scents of these matters, ought to induce us to abandon their employment, and to substitute others for them. And we may likewise add, that the emanations which they diffuse in the workshops or mills, are frequently inconvenient; and it would, therefore, be much better to sell them to the manufacturers of oil gas. Plumbago, or the carburet of iron, has been successfully used for diminishing friction in machinery; but this material is too rare and costly to be ordinarily used. There are, however, other unctuous minerals to which we may recur, and amongst these, steatite seems to hold the first rank.

The citizens of the United States of North America, who cultivate with success the employment of machinery, as we may judge from their numerous steam boats and other machines, both for naval and other purposes, appear to be the first persons who have employed steatite in the large way. It is not, however, used alone, but mixed with a small quantity of oil, suet, or tar. They commence by reducing it to a very fine powder, and then mixing or triturating it with the material intended to render it more unctuous. The first experiments on using it were made at Lowell, in the state of Massachusetts; and the coachmen and wagoners have found it highly beneficial.

Mr. Moody, superintendent of the great iron works established upon the mill dam, near Boston, has afforded us means of estimating the advantage to be derived from the use of this new mixture. In one of the works is a wheel of great size and weight, which makes from 75 to 100 revolutions per minute, and turns upon necks or gudgeons of five inches in diameter. It has moved with this speed during three, and sometimes five, weeks together, without renewing the lubrication of the gudgeons. Nevertheless, Mr. Moody thinks

it best to renew it oftener. The machinery, of which this great wheel forms a part, manufactures about 200,000 pounds of iron per month.

It is to chance, that we are indebted for the discovery of this valuable employment of steatite, the use of which is now continually extending in the United States; and will also, no doubt, be speedily adopted in Europe.

Additions by the Editor of the Technological Repository.—Steatite is also used in the United States to line furnaces with; a type founding machine, sent from thence, and patented here, had a furnace of this kind. And the Editor lately saw, in the hands of Mr. Lemuel Wellman Wright, engineer, a cubic mass of it, a foot square, and which had been sent to him by an American friend. He had sawn off a portion of this block, and exposed it to the heat of his fire for several hours; after which, it had assumed the appearance of a mass of *mica*, still, however, cohering together. The Chinese also make small portable furnaces of steatite.

The *lapis ollaris*, or potstone, is also another variety of steatite. Bishop Burnet gives the following account, in his travels, of the mode of using it in Switzerland. "There are a sort of pots, made of stone, which are used, not only in all the kitchens here, but also in those of almost all Lombardy, called *Lavege*. The stone feels oily and scaly, so that a scale adheres to the finger of any one that touches it, and it is somewhat of the nature of slate. There are but three mines of it known in these parts; one near Chavennes; another, in the Valteline; and the third in the Grisons; but the first is much the best. They generally cut it round in the mine, in masses of about a foot and a half in diameter, and a foot and a quarter in thickness; and they work it into shape in a mill, where the blocks of stone are driven about by a wheel, set a going by water; and which is so ordered, that he who manages it, turns the outside of the stone, first, till it is quite smooth; and then separates one pot after another, by small and hooked chisels, by which means he makes a nest of pots, one within another; the outward and biggest one, being as large as an ordinary cooking pot, and the inward one, no larger than a common pipkin. These pots they arm with hooks and circles of brass; and so they are used by them in their kitchens. One of these pots heats and boils sooner than any metal pot; and yet the bottom is twice as thick as that of a metal one. It never cracks by the heat, nor gives any sort of taste to the liquor that is boiled in it; but if it falls to the ground, it breaks, as it is very brittle; nevertheless, it is soon repaired again; for they piece their broken pots so close, by sewing the broken parts together with iron wire, which completely fills the holes they make to receive it, that there is no breach made, although no cement is used. The passage to the mine is very inconvenient, for they must creep for near half a mile through a rock, which is so hard, that the passage is made not above three feet high; and so that those who draw out the stones, creep all along upon their belly, having a candle fastened to their forehead, and the stone laid

upon a sort of cushion, made for it upon their hips. The stones are commonly two hundred weight." [*Ib.*

On Purifying Linseed and Rape Oils. By Mr. Thomas Cogan.*

Of the seed oils, those which are in the greatest demand are from rapeseed and linseed. In France, and in most other parts of continental Europe, rapeseed oil is that which is generally used for lamps; but it will not give a clear light till it has been freed from the mucilage and other matters, which, when heated, become charred, and thus load the wick, and by obstructing the capillary action, impair the free supply of oil. Acids, properly applied, will precipitate the mucilage; but long subsidence, or tedious filtration, are necessary for this purpose; and after all, the oil is found still to retain some acid, or at least its properties have undergone some change, which diminishes its inflammability.

Linseed oil is not made use of in lamps, but there is an immense consumption of it, as the basis of oil paints, both of those that are used in house painting within doors, and of those that are employed by the artist. Linseed contains so much mucilage, that it is necessary to roast the seed, more or less, in order to enable it to give out its oil to the action of the press; and on this account the oil, which naturally has only a pale yellow colour, is generally reddish brown, from the previous roasting of the seeds, and still contains also a considerable proportion of mucilage. By separating from the oil this scorched mucilage, it is much improved as a vehicle for white and pale colours, and is also better able to resist the action of air and weather.

M. Thénard was, it appears, the first who published a method of freeing seed oils from their mucilage, by the action of sulphuric acid; but the subsequent separation of the charred matter, by long standing, or by slow filtration, was a great objection to the process; and the attempt to wash out the remains of the acid, by mechanical agitation of the oil with water, either cold or warm, was far from being fully successful.

Mr. Cogan's process, though resembling M. Thénard's in the first part of it, is completed by the judicious introduction of steam; by means of which the oil appears to be almost entirely freed from acid, and the black feculent dregs subside in the course of twelve hours, leaving the supernatant oil quite clear, and greatly improved in colour, and in those qualities for which it is valued by the painter.

The quantity that he operates at once is about 100 gallons. For this, three quarts, that is, about ten pounds of sulphuric acid (oil of vitriol) is required. The acid is to be diluted with an equal bulk of water. The oil being put into a copper pan, of the shape of a

* From vol. XLVI, of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce, just published. The Society voted its silver Isis medal, and ten guineas, to Mr. Cogan, for his discovery.

boiler, two quarts of the dilute acid are to be added; the whole is then stirred up very carefully for an hour or more with a wooden scoop, till the acid has become completely incorporated with the oil, and the colour of this last has become much deeper than at first. A second similar quantity of acid is then to be added, and mixed with the oil in the same way as the first was; and after this, the remaining third part is to be added. The stirring of the oil is to continue incessantly for about six hours in the whole, at the end of which time the colour of the mixture will be almost that of tar. It is then to be allowed to stand quiet for a night, and in the morning is to be transferred to the boiler; this is of copper, and has a steam pipe entering it at the bottom, and then dividing into three or four branches, each of which terminates in a perforated plate. The steam, thus thrown in, passes in a very divided state into the oil, penetrates into every part of it, and heats it to the temperature of boiling water. The steaming process is to be continued for about six or seven hours, when the oil, &c. is to be transferred to a cooler, of the form of an inverted cone, terminating in a short pipe, commanded by a stop cock inserted in its side, a few inches from the bottom. After remaining a night in the cooler, the oil is fit to be withdrawn; for this purpose the cock at the bottom is opened, and the black watery acid liquor flows out. As soon as the oil begins to come, the cock is closed, and that in the side of the cooler is opened. From this the oil runs quite clear and limpid, the whole of that which is still turbid remaining below the upper cock. The purified oil being drawn out, that which is turbid is let out into a reservoir, where it either remains to clarify by subsidence, or is mixed with the next portion of raw oil.

On the so termed Chinese Rice Paper.[*]

This article is imported into this country in considerable quantity, and is employed as a material for artificial flowers, and for other ornamental purposes. Its common name shows the popular opinion respecting its origin. The subjoined extract from a letter by John Reeves, Esq. of Canton, a member of the Society of Arts, proves, however, that the rice paper is not a manufactured article, but an unchanged vegetable production, cut spirally, and afterwards flattened by pressure.

Canton, March 7, 1826.

Sir,—My son will soon forward to you a sheet of the substance, called in England "rice paper," and the piece of the plant (or I should rather say, of the branch of the plant) from which it is made; but whether this is a tree or shrub I cannot at present discover, as the person from whom I had my information, had only seen the mode of cutting and using the plant.

The branches being cut into lengths of the intended, or usual breadth of the sheet of rice paper, are placed upon a thick piece of

[*] From vol. XLVI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

copper, with two raised edges, as guides to keep them steady; and being held in the left hand, are presented to the edge of a large knife, about ten inches long, and three inches broad, made very sharp, and held in the right hand.

A slight incision being made in the piece of branch for its whole length, it is kept moving round by the left hand, while the knife is also kept in motion by the right hand, and is thus sliced or pared down from circumference to centre, and then spread out to flatten.

The sheets are usually made up into bundles, of nineteen or twenty pieces each, which weigh about twenty-three ounces, and are sold wholesale, for about one dollar a bundle.

The refuse pieces, such as that sent you, are used for making artificial flowers.

It is chiefly brought from the island of Formosa, by the Chinese junks; hence is the difficulty of ascertaining the nature of the plant; as few, if any, of the persons concerned in the sale of the prepared article at Canton, have ever seen from what it is made.

I am, sir, &c. &c.

J. Reeves.

Remarks by the Editor of the Technological Repository.—We have long been of opinion, from microscopic observations, that the so termed "Chinese *rice paper*," was an organized vegetable production, much resembling in its structure *the pith of elder;* and our opinion is now fully confirmed by Mr. Reeves's letter.

It appears to us, that the two raised edges upon the sides of the piece of copper, serve not only as guides to keep the pith steady, but also *to regulate the thickness of the slices;* the knife lying upon their tops, and the piece of pith being held down upon the bottom of the plate of copper, and gradually turned round and presented to the edge of the knife, whilst it is carried along backwards and forwards; the slice cut will pass underneath the knife, and escape at the front of the plate, and be succeeded in its turn by the remainder of the slice, until the operation is finished.

We have no doubt that cylindrical pieces, either of elder or other pith, might be found in this country, quite large enough to bear slicing in this manner; and which slices, after being flattened by pressure between plates, (possibly warmed or heated) might serve as substitutes for those of China, and be equally capable of receiving any colours. We now see beautiful figures cut out of elder pith, by a skilful hand, exposed for sale in most of our philosophical instrument maker's shops, for electrical experiments, and hope soon to see leaves of it formed in the same manner.

On the Colouration of Golden Articles of Jewellery. By M. Castellani.

[From the Bull. Univ.]

The two best mixtures, according to M. Castellani, for the purpose of giving a good gold colour to articles of jewellery, are as follows:—

Muriatic acid at 22°, - - -	10 parts.
Oil of vitriol, - - - - -	4
Crystallized boracic acid, - - -	2
Water, - - - - - - -	150

Or,

Acid muriate of alumina (liquid,) -	13
Crystallized sulphate of soda, - -	4
Crystallized boracic acid, - - -	3
Water, - - - - - - -	150

Either of these mixtures, with twenty grains of neutral muriate of gold, constitutes the bath, which is to be used in the following manner:—A large glass matrass, carefully luted at the bottom, is placed over a circular furnace, so as to have heat readily applied to it; the solution is to be put into it, and when at the boiling point, the pieces of jewellery, previously cleaned and picked, are to be introduced, suspended upon golden wires. After a few minutes, a copper wire is to be immersed, and left until the gold has acquired a deep colour; it is then to be withdrawn, but the articles still left in until they have acquired the colour necessary. They are then to be put into warm water, acidulated by sulphuric or acetic acid, to remove particles of oxide of copper, washed in clean warm water, and dried near a fire.

Generally, a single operation is not enough; for, as a long immersion produces harm from the oxide of copper, it is better to shorten it, and repeat the operation. The colour produced by several immersions is always the best; that by one long immersion is red, and often requires the articles to be entirely cleaned and recoloured.

The mixtures above have been used for golden articles containing one-fourth of copper; other alloys would probably require other proportions. When the articles are large and thick, the immersion should be longer than for small, thin, or narrow ones. As the bath is good in proportion to the gold it contains, when, by successive colourations, that has been removed, a few drops of muriate of gold should be added, and sometimes portions of the other constituents and of water. The copper wire is oxidized in the process, and sometimes covered with a film of gold, in which case it should be changed or cleaned. If an intense yellow colour is required, the immersion should be frequently repeated, and the copper brought into contact. If a pale colour is required, the last immersion should be at the boiling point, and the copper wire ought not to touch.

Bronze articles, gilt by amalgamation, may be coloured in the same way; but M. Castellani has not as yet determined the best mixture for the bath.

Machine for beating and hackling Hemp and Flax. By M. Lorillard.

The machine invented by M. Lorillard for beating and hackling hemp and flax consists of a balance of a triangular form, having its obtuse angle reversed and furnished with an axis turning on supports,

so that the two small sides of the triangle may take alternately, the one a horizontal position, and the other the inclination of 45 degrees. These two sides are furnished beneath with blades, arranged some parallel and others oblique to one another; and these blades take between others fixed on a horizontal strong piece of wood, in the direction of the balance beater, and which is supported by a wooden frame. The workman acting on a lever attached to the extremity of the balance, makes the beater descend alternately, by a vibrating motion; by this means it breaks the hemp and flax, which another workman places on the lower blades. The substance thus beaten twice over, first between the parallel blades and afterward between the oblique ones, is stript of its woody substance (sa chenevotte.) It is afterward submitted to the action of an apparatus composed of two plates of wood grooved in the same direction, between which it undergoes a friction which deprives it of its resinous gum. It comes out of this apparatus in a state of perfect softness to be afterward passed through combs or hackles of different degrees of fineness, arranged for that purpose on the frame of the machine.

[*Bull. de la Soc. d'Encouragement.*

The history of the invention and improvement of Achromatic Telescopes.

One of the finest discoveries of the eighteenth century, is that of the *achromatic telescope;* and, if we owe to those founded on the principle of reflection, the great discoveries of sidereal astronomy, it is by means of the achromatic telescope, as applied to transit instruments and divided circles, that the nicest measurements of celestial arcs have been taken, and those accurate results obtained which have led to the completion of astronomical theories, and to the perfection of the lunar and planetary tables.

After the penetrating genius of Sir Isaac Newton had pronounced the improvement of refracting telescopes to be despaired of, no slight honour must belong to the individual who dared to hope where Newton had desponded, and who triumphed over the difficulties which baffled the theoretical and practical skill of the high priest of nature. This fortunate individual was Mr. Chester More Hall, of More-Hall in Essex, a name scarcely yet embalmed among the sacred relics of science. In imitation of the divine mechanism of the human eye, he was led, in 1729, to the combination of media of different refractive powers; and, in 1733, he had actually completed several achromatic object glasses of flint and crown glass. No account of this invention was published; and there can be no doubt, that when John Dollond began his experiments, he was entirely ignorant of the previous labours of Mr. Hall. When he succeeded, therefore, in 1758, in the invention and construction of this noble instrument, he obtained, as he justly deserved, all the honours of a first inventor; and when he introduced these telescopes into actual use, and made them an object of English manufacture, in which no foreign nation could

compete with us, he conferred a service upon his country of no ordinary kind. That service, however, though it exalted the honour, and improved the revenue of the nation, stands unappreciated and unrequited in her annals; and, as if the great dispenser of justice had frowned upon the ungrateful deed, no improvement upon the achromatic telescope has been allowed to mark the future progress of English science;*—it has passed into foreign states as an article of trade, as well as an object of glory, and the sovereigns of other lands have fondly welcomed into their territories what we had dishonoured and rejected. Attempts, hitherto fruitless, have been made to perfect the invention of Dollond, and to extend its power. The Royal Society, too, has been roused from its long and deep slumbers; they have appointed a committee to make experiments on the manufacture of flint glass for achromatic telescopes;—they have erected an experimental glass house; and government were persuaded to extend to them the mighty privilege of melting a few pounds of glass without being visited and taxed by the excise officer. For half a century after the death of Dollond, no philosopher or artist in England was allowed to make experiments for the improvement of flint glass, without paying the tax to government, and without submitting to the harassing interruptions of the tax gatherer. Nay, by a singular refinement of extortion, a pound of glass re-melted *fifty* times, was liable to the duty upon fifty pounds!† Under these circumstances, we hailed the appointment of the glass committee, and the remission of the excise regulations, as an era in science; but ardent as we are in every measure that can endear the name of England, and advance its interests, we are compelled to state, that this committee never will, and never can accomplish the object for which they were associated. Their chemical and physical knowledge will doubtless avail them much in such an inquiry; or if preferred to an enterprising individual, whose fortune or renown depended on the issue, it might in all probability ensure him of success. But how is it possible to suppose, that Mr. Davies Gilbert, Sir H. Davy, Dr. Young, Mr. Herschel, and Mr. Babbage, can spend their hours and their days in the atmosphere of a furnace? Will they leave the pursuits which have already immortalized them, to labour in a cause in which success would neither inspire gratitude nor command requital? Will they, in fine, devote themselves to re-discover a discovery which has been already made by a Swiss peasant, in the gorges of the Jura,

* There are telescopes executed by John Dollond, which, we believe, have not been surpassed by any since made of English materials, and by English workmen. Many improvements have been proposed, but none of them have yet come into practical use, or have been substituted for the common achromatic telescope.

† The writer of this paper feels himself entitled to utter these complaints. He had laboured many years on the theoretical part of this subject, and when, in commencing to put his views in practice, he asked the assistance of a friend, he learned with grief and indignation, that he had subjected himself to the statutory penalties. Need we add, that his hopes and his crucible were together dashed upon the ground.

and which the British government could have purchased for a paltry equivalent.

The history of M. Guinand's labours possesses a peculiar interest. An English achromatic telescope found its way to the village of Brenetz, in the canton of Neuchatel. A defect of sight had compelled M. Guinand, a maker of watch cases, to construct his own spectacles. From this he was led to grind the lenses of small refracting telescopes, which he mounted in tubes of pasteboard. To such a mind, the sight of the achromatic telescope which belonged to his master, must have been an object of high interest. He was allowed to separate the lenses, and study its properties, and such was his zeal to imitate this optical wonder, that he commissioned some flint glass from England, and actually constructed with it several achromatic telescopes. The badness of the glass, however, and the impossibility of procuring it of the size he required, inspired him with the ambitious resolution of making good flint glass for himself! We are sure that no chemist in England or France would have ventured on such a task with any hopes of success; but ignorance was in this case power; and glass fortunately was not an exciseable commodity in the village of Brenetz. He studied the chemistry of fusion;—between 1784 and 1790, he made daily experiments in his blast furnace with meltings of three or four pounds each;—he noted down the circumstances and the results of each experiment. Partial success invigorated his ever failing efforts, and the news of learned academies having offered prizes for the object at which he strained, animated him with fresh and glowing excitements.

Having abandoned his profession for the more lucrative one of making bells for repeaters, his means became more ample, and his leisure hours more numerous. He purchased a piece of ground on the banks of the Doubre, where he constructed a furnace capable of fusing *two hundred weight* of glass. The failure of his crucibles, the bursting of his furnace, and a thousand untoward accidents, that would have disconcerted any other mind, served only to invigorate his. The disappointments of one day were the pedestal on which the resolutions of the succeeding one reached a higher level; and in the renewed energy of his spirit, and the increasing brightness of his hopes, the unlettered peasant seems to have felt that fate had destined him to triumph. The threads, and specks, and globules which destroyed the homogeneity of his glass, were the subjects of his constant study; and he at last succeeded in obtaining considerable pieces of uniform transparency and refractive power, amounting sometimes to twelve, and in one case to eighteen inches in diameter. He at last acquired the art of soldering together two or more pieces of good glass, and though the line of junction was often marked with globules of air, or particles of sand, yet by grinding out these imperfections by means of a wheel, and by replacing the mass in a furnace, so that the vitreous matter might expand, and fill up the hollows so made, he succeeded in effacing every trace of junction, and was consequently able to produce with certainty the finest disks of glass.

Rumours of Guinand's success had now begun to spread throughout Europe, and the first philosopher who availed himself of the intelligence was M. Fraunhofer, of Munich, who had the charge of the optical part of the establishment of Benedictbaiern. He was so pleased with the specimens which were sent to him, that he repaired, in 1804, to Brenetz, and persuaded M. Guinand to go on to Bavaria, where he settled in 1805, and continued for nine years engaged in the manufacture of flint glass.

In 1820, long after his return to Switzerland, the celebrated French artist, M. Lerebours, visited him, and not only obtained all the glass which M. Guinand then had, but commissioned a fresh supply. M. Cauchoix, another excellent Parisian artist, procured other pieces, and splendid achromatic telescopes have thus been manufactured in the French capital. Though possessing the deepest interest, England seemed the least alive to these great discoveries. She sent no delegate to Brenetz—she made no offer for the secret; but, in 1822, a piece of Guinand's glass was obtained by the Astronomical Society of London, and formed into a telescope by our excellent artist, Mr. Tulley. Its homogeneity and purity, nay, its absolute perfection, has established the value and the efficacy of Guinand's process.

The visit of Guinand to Munich, in 1805, led to a new era in the history of the achromatic telescope. Commencing with all the knowledge of the Swiss artist, Fraunhofer devoted his mind to the perfection and simplification of his methods. Striæ, and imperfections of a minute kind, which the practised eye of an optician could alone detect, still required to be eradicated; and even the crown glass, which had hitherto been supposed an object of easy attainment, required the labour of a whole year to bring it to perfection. In order to gain these ends, Fraunhofer re-constructed the furnaces at Benedictbaiern, procured all the instruments which were necessary for his purpose, and took upon himself the charge of all the meltings. Four quintals of glass was the average quantity with which he wrought, and he at last succeeded in determining the causes of his failure, and in obtaining distinct processes, by which he could manufacture disks of flint glass, eighteen inches in diameter. In these laborious and perplexing experiments, Fraunhofer injured his health, and quickened the progress of that insidious disease which carried him off so prematurely from the sciences.

But while Fraunhofer had thus supplied himself with the finest materials for his art, he had prepared his mind, by the study of optics, both in its mathematical and practical branches, for carrying into effect his great views for the improvement of the telescope. His discovery of fixed lines in the spectrum enabled him to determine, with minute accuracy, the absolute, as well as the relative, refractive and dispersive powers of his glass; and his skill in practical mechanics conducted him to the construction of a machine for giving the last polish to his lenses, an operation in which the errors of the previous process of grinding were corrected, in place of being

exaggerated, and in which the result was made perfectly independent of the skill of the workman.

With such means and accomplishments, Fraunhofer began the most difficult task to which human genius was ever applied. The resources of his powerful mind never, for a moment, failed him; and though the malady which beset his delicate frame often broke the continuity of his labours, and though disappointment often threw its shadows across his path, yet, sustained by the ardour of his genius, and by the liberal patronage of his sovereign,* he triumphed over every obstacle. The great achromatic telescope of Dorpat, with which professor Struve has made such important observations, will remain an imperishable monument of his genius, even if it has not been exceeded by his later, and, we believe, larger instrument. Had he been spared a few years, he would have astonished Europe with an achromatic object glass *eighteen inches* in diameter; but the honour of executing such a work has been left for another age, and probably for another country than Bavaria. We have not been able to learn to what extent his partner, and his workmen, possess the methods and processes of Fraunhofer: but, even if he has not left his mantle behind him, the force of his example remains, and we gladly indulge the hope, that the spirit of science and commercial enterprise will be again combined in the continuation of his labours.

The eighteenth century is an age that will ever be noted in the annals of the world, as one in which science of all descriptions made a progress unexampled in the whole previous annals of the world. It is also in the branch of science we have been considering that this progress has been the most marked. The theory of gravitation, proposed by Newton at its opening, has been pursued, and applied, during its lapse, to all the known existing combinations of bodies and motions; and was, at its close, completed by Laplace. Proofs irrefragable and incontrovertible have been obtained of the motion of the earth, both diurnal and annual. The dimensions of the solar system have been ascertained, and the sun and planets weighed as in a balance; while the discovery of a new and distant planet, at the close of this age, has doubled the bounds of the kingdom of the sun.

Instruments, and methods of observation, have been so far improved, from a comparatively imperfect state, as to leave little to desire or look for hereafter.

The astronomers of the early part of the present century have made some few, but important discoveries, that probably complete our knowledge of the district of creation in which our earth is situated; and those of the present day, like Alexander, seek for other worlds to conquer. Unlike him, however, they have no cause to weep, for in the regions of immeasurable space there exist, within our ken, bodies, and systems, and motions, that may, for ages to come, task their utmost exertions. [*Extractor.*

* Maximilian Joseph, king of Bavaria—*clarum et venerabile nomen!*

Some account of the Structure and Operation of GURNEY'S *Steam Coach. By* C. H. WILKINSON.

SIR,—I presume, from the great public attention excited by Mr. Gurney's steam carriage, that a short account of the means by which the whole is propelled, may prove interesting to your readers. I confess that, previous to the opportunity afforded me by the liberality of the patentees at their late visit to Bath, that I contemplated all attempts to substitute mechanical powers for living action as impracticable, unless the resisting medium is in a uniform measured degree, as in rail-roads, &c. It appeared to me, that the constant changes arising from the inequalities of roads, and those ascents and descents which are in the line of communication between Bath and London, could never be counteracted by that perpetual alteration in the force of steam, as such conditions would require. The horse in an instant accommodates his force to the degree of resistance to which he is exposed; the construction of an inanimate machine, competent to produce corresponding effects, appeared to me to be attended with insuperable difficulties. Mr. Gurney's journey to Bath, and his return to London, have induced me to believe that the principal point is attained; and I think the patentees have judiciously concluded to confine its operation to short stages from London, which will afford them opportunities of rendering it more perfect before any extensive line of road is proceeded on. The merit of every machine principally depends on its simplicity. In this respect Mr. Gurney's plan is entitled to every admiration. The power he generates is very little reduced by friction, and nearly its whole force is employed, as the propelling agent. The boiler, or generator, as it is termed, consists of about twenty gun barrels, three feet in length, communicating at each end with an iron tube, by which arrangement a general communication is effected with every tube, and the barrels are about one inch from each other, and serve as a grating for the fire above, which is fed with coke from the inside of the carriage; a second fire is placed under the barrels, and supplied from the outside; so that this chain of tubes is placed between two fires; these tubes are completely filled with water, so that whatever degree of heat is employed, the water retains its fluid form, and does not assume a vaporific character before its liberation from the heated barrels; if any additional portion of water be determined into these barrels with a force capable of overcoming the resistance of the valve, then a corresponding portion of water passes into an iron cylinder, about seven or eight inches wide, and two feet long, and immediately flashes into steam; this part of the machine is called the separatory, and answers an important purpose in regulating the force of steam; suppose ten drops of water be converted into steam, at a temperature of 212 degrees, that steam, subsequently exposed to any higher degree of temperature, will not have its powers of pressure increased without an additional dose of water—the separatory supplies the deficiency; so, on the contrary, if the fire be not sufficiently active, the steam contains a surplus of water, and which excess is

deposited in the separatory, and prevents the working cylinders from being overcharged with that fluid; from the separatory the steam is alternately determined into two cylinders, which are six inches in diameter, with a stroke of 20 inches; the rods of the pistons are attached to cranks on the axle of the hind wheels, these cranks are reverse to each other, and hence by the reciprocating action of the pistons, a complete revolution of the axis takes place; at each end of the axis is a bar of iron the width of the wheel, and secured at each end by bolts to the circumference; by this adjustment the powers of the pistons are advantageously applied to the circumference of the wheel, and the strain prevented which would be the result, if nearer the nave. As the pistons are elevated by the steam, two pumps are worked by rods going through stuffing boxes, and are attached to the piston at the other end; these pumps communicate with the cistern of water, a small portion of which is determined into the generator, to produce the effect already noticed; the stream is afterwards directed into a cooling cylinder, through a worm, part of which is condensed, and returned to the cistern, and the other portion passes immediately through the chimney into the atmosphere.

The average pressure is about eighty pounds to the square inch of the surface of the piston: it is ascertained that double the pressure does not require the same proportionate increase of fuel; and as economy in this respect is of great importance, the steam in the first instance possesses a power equal to one hundred and sixty pounds, and the communication with the separatory is cut off when the piston has moved through half its range, the expansion of the steam is competent to effect the passage of the pistons through the remaining part of the barrel.

Close by the engineer is a governor, by which he is enabled to regulate the steam, either by increasing its force or diminishing its quantity; and this important part of the operation is managed with great facility.

From coke being employed, and the steam considerably cooled, there is no perceptible smoke, nor clouds of vapour, and the cylinders working about thirty times a minute, the same number of revolutions of the hind wheels take place, supposing the circumference to be fifteen feet, the velocity would be nearly six miles per hour; on level ground, it will move through three times this space, so that there would be ninety strokes per minute; under such circumstances, the steam has a less pressing power, from the water not remaining so long in the generator. The metal which is employed is forged iron; if from any circumstance the pressure of the steam should overcome the resistance of the metal, no explosive effects would be the result, and no dangerous consequences would follow; the iron would rend, and the steam would escape through this small separation, and the action of the machine is necessarily stopped, and it is only by such a cessation that a solution of the continuity in any part of the apparatus is suspended.

One bushel of coke will suffice for two miles, and one gallon of water is consumed each minute: hence every eight or ten miles a

fresh supply of water is required, and every twenty or thirty miles, coke.

From a comparative statement of the relative expenses, if we estimate the apparatus and wear equal to four horses, the engineer and stoker as corresponding to the coachman and guard, then the expenses will be reduced to the small compass of travelling. I understand that four horses are estimated at 2s. per mile; while the coke required would not exceed 3d. so that the difference of expenses would be as 3d. to 2s.

Probably a more important result would arise whenever the time shall arrive for the general employment of this mode of travelling: upon a moderate computation, in the British dominions, a million of horses are appropriated to this purpose, as each horse consumes that produce from land equal to the support of seven men, a change of agriculture would be the result, and food for seven millions of inhabitants thus created. From such a reflection, I am induced to conclude with the noble duke at the head of our government, that the advantages are probably incalculable. [*Register of Arts.*

Notice of Chrome Orange.

In Brande's Quarterly Journal, from October to December, 1829, Mr. Graham remarks, "It is singular, that, although no other colour has been so much run upon for a couple of years in cotton yarn, no account of the mode of raising this beautiful tint, so far as I can learn, has hitherto been published; yet this process is universally known, and followed by dyers. The first object is, to procure upon the yarns a good body of chrome yellow, of the ordinary and familiar tint of chromate of lead. For this purpose, the goods are well charged with protoxide of lead, which is done by dipping them in a solution of acetate of lead, and then decomposing the salt by lime water, of which the lime takes the acetic acid, and leaves the oxide of lead in the cloth. Every trace of lime must then be got rid of by washing.

It is necessary to have nothing but oxide of lead on the cloth; for, with acetate or nitrate of lead, as the mordant, the colour will be uneven. The goods are then passed through a bath of bi-chromate of potassa, which instantly strikes the chrome yellow with the oxide of lead.

The orange is raised by throwing the goods so prepared into lime water at, or near, a boiling heat. Lime, at that temperature, appears to be capable of partially decomposing the chromate of lead, taking half the chromic acid from a greater or less portion of that salt, and reducing it to the state of di-chromate of lead. The di-chromate of lead is itself of a full red colour."